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THE MYSTERY OF THE ICE AGE AND ITS SOLUTION.

BY MAJOR-GENERAL A. W. DRAYSON, F.R.A.S.

From the earliest date, when geologists discovered, from an investigation of the earth's surface, that some very different conditions had prevailed just previous to those which now prevail, the so-called Ice Age has served as an excellent battle-field for rival theorists.

In former times this period in the earth's history was generally spoken of as the "Boulder Period," because there was positive evidence that portions of rocks weighing several tons had been transported many miles from their sources and deposited on the surface of the earth where no rocks of a similar formation existed. During many years the cause which had produced these effects was a mystery. Speculation after speculation was put forward in the vain endeavor to explain the facts, but each of these failed to solve the mystery.

A few able reasoners, among whom were Agassiz and Robert Chambers, having carefully examined the facts, stated that the only solution of these was that ice was the principal agent in transporting these boulders. For at least twenty years theorists fought against this explanation; but these opponents either died out, still unconvinced, or, finding the facts too strong for them, maintained a masterly silence, and

that which had been termed the "Boulder Period" became usually spoken of as the "Glacial Epoch."

As investigations advanced, it was found that the effects of this Glacial Epoch were universal over the Northern Hemisphere, and down to about 54° of latitude. Although there is very little land in the Southern Hemisphere south of 54° latitude, yet in the southern parts of South America, and even in portions of New Zealand, there was direct evidence to prove that those regions had also been subjected to a Glacial Epoch.

Further investigations revealed the fact that this Glacial Epoch, or change of climate, came on gradually, reached a maximum, and then gradually retreated. In fact, it appeared as though the cold of the Arctic circles, which circles now extend about 23° 27′ from the Poles, had gradually extended till they reached as far as 54° latitude, and had then gradually retreated.

Geologists, finding that the change of climate necessary to produce the effects of the Ice Age would be produced by this extension of the cold of the Arctic circles, appealed to astronomers, in the hope of obtaining help from astronomy. These at once stated that no such help could be given; that as the Arctic circles were at present, so had they remained, with very slight variation, from the creation. They said that the Pole of the Heavens traced a circle around the Pole of the Ecliptic as a centre, keeping constantly 23° 28′ from this centre, and although there was a slight decrease at present in the obliquity, yet this decrease was kept within very narrow limits. M. Laplace, the French mathematician, was appealed to, and, after an elaborate application of theories, pronounced it impossible that the plane of the Ecliptic could vary more than 1° 21′ from a mean position.

Geologists, however, were unfortunately not possessed of the slightest knowledge of geometrical astronomy. They seemed to imagine that the "plane of the ecliptic" was the same thing as the obliquity of the ecliptic, and because it was stated that "the plane of the ecliptic" could not vary more than 1° 21′, it followed as a matter of course that the

obliquity, or extent of the Arctic circles, could not vary more than 1° 21′.

Since geometrical astronomy has been a science, no more erroneous statement than the above has ever been promulgated and accepted. Strange to say, it still continues to be repeated by men claiming to be acquainted with science, though the error was exposed twenty-two years ago. A variation in the obliquity depends mainly on the course which the earth's axis traces, relative to the Pole of the Ecliptic, and, strange to say, neither M. Laplace, nor any other geometrical astronomer, ever thought it worth while to investigate this course as a purely geometrical problem, independent of theories.

It was more than thirty years ago that I commenced to investigate by geometry, based on recorded observations, what was the curve that the Pole of the Heavens actually traced. The labor of this investigation was great, and the greatest accuracy was required when making the requisite calculations. As I proceeded, I found how actual facts contradicted several of the accepted theories of the day, and after several years I found what the true curve actually was. Having discovered this curve, I knew that by its aid I should be able to arrive by calculation at results which could not be made by those who were unacquainted with what I had discovered. To give an idea of what these calculations are, I copy below a portion of a letter from Admiral de Horsey, which he permitted me to publish a short time ago. These calculations refer to the astronomical portion of my problem, but in this article I purpose dealing almost entirely with that portion of it which explains the cause of the Boulder Period or Glacial Epoch, or, as it is now usually termed, "The Ice Age:"

"Melcombe House, Cowes, 23d April, 1894.

"Dear General Drayson:—As you are aware, I have, during several months, been engaged testing by numerous calculations the accuracy, or otherwise, of your discovery of the second rotation of the earth. This pursuit has been of

enthralling interest to me, and you may now like to know the result. Among these calculations (in all of which I have made no use of Solar tables, or rate per year), were the following: Starting from the date A. D. 2295–2, I calculated by your system what the obliquity of the ecliptic would be for the year 1885, working the problem by spherical geometry. On comparing my calculated obliquity with that recorded in the Nautical Almanac I found a difference of only 0.07 seconds. I then took the recorded R. A. and declination of the stars *eta* Ursæ Majoris and *alpha* Draconis from Bradley's Catalogue of 1st January, 1755, and (as I have said, for all cases, without making any use of the rate of change, now found only by perpetual observation), I calculated the R. A. and Decn. of these stars for the 1st January, 1895. On comparing my results with those given in the Nautical Almanac, I found a difference in 140 years, for *eta* Ursæ Majoris of only 0.063″ in R. A., and 1.66″ in Decn.; and for *alpha* Draconis 0.156″ in R. A., and 1.45″ in Decn. Again, working *alpha* Draconis from 1755 to 1875 (120 years), I calculated its R. A. for 1875 to be 14 hours 1 minute 0.121 seconds, and Declination plus 64° 58′ 25.2″. These results I could not compare with observation, as, the star being omitted from the 1875 Nautical Almanac, its position apparently was not known at Greenwich. Determined to apply a crucial test, I selected the stars *lambda* Ursæ Minoris, close to the North Pole, and *sigma* Octantis, close to the South Pole, stars having an annual variation in R. A. respectively twentyfold and thirty-sixfold as great as the average. Calculating *lambda* Ursæ Minoris from 1850, I found its R. A. and Decn. in 1895 to be within 0.249″ and 0.065″ respectively, of the results by observation (and by rule of thumb for four years in advance) recorded in the Nautical Almanac. Then, calculating *sigma* Octantis from 1875 I found its R. A. and Decn. for 1895 to be within 4.251″ and 0.28″ respectively, of the Nautical Almanac record. Astronomers will think little of a difference of R. A. of 4¼″ in the case of a star which, in the twenty years, changed 2,141″, and which, being within 44′ of the Pole, must hang

on the wires of the transit instrument for a considerable time.

"I am fully aware that the above calculations are unknown to all astronomers to whom you have not explained your system. They are problems which any one with ordinary mathematical ability can work, if he knows your system. Without this knowledge, and without accepting your discovery to be true, I believe no living man can work them. To the Astronomer Royal, to the Royal Astronomical Society, and to all the learned professors in the four quarters of the globe who adhere to their text-book knowledge, I believe these problems to be as insoluble as they would have been to Lobengula's medicine man."

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On tracing out the curve, I found it distinctly marked that the Pole of the Heavens had, during the past 1,800 years, moved round the arc of a circle, the radius of which was 29° 25′ 47″. No other curve or radius would explain the facts. The centre of this circle was 6° from the Pole of the Ecliptic. Consequently, instead (as had hitherto been asserted) of the Pole of the Heavens tracing a circle round the Pole of the Ecliptic *as a centre*, and keeping constantly 23° 28′ from this centre, I found that the Pole was tracing a circle round a centre 6° from the Pole of the Ecliptic. As the circle thus traced was much longer than the circle hitherto supposed to be traced, the completion of this circle would necessarily occupy a longer time, *viz.*, about 31,600 years, instead of about 25,000 years, as had hitherto been asserted.

In consequence of the centre of the circle traced by the Pole being 6° from the Pole of the Ecliptic, it followed that during the tracing of this circle, the two Poles must vary their distance 12°, and hence, during this period, there must have been a variation of 12° in the extent of the Arctic circles and tropics. The dates at which the various changes occurred were easily ascertained. About 3,000 years ago, the Arctic circles extended about 2° more than at present. About 7,000 years ago they extended about 6° more than at present. At

about 13,500 B. C. the Arctic circles extended 12° more than at present, which was the maximum extension. At about 21,000 B. C. they extended only about 6° more than at present, and at about 24,000 B. C. they extended only about 2° more than at present. Hence a geometrical analysis of the course traced by the earth's axis not only enabled me to make accurate calculations in astronomy hitherto unknown, but revealed the fact that the Arctic circles had gradually extended, reaching a maximum at 13,500 B. C., and had then gradually contracted.

At the date to which I refer, I had a very superficial knowledge of geology. I had heard of the Boulder Period, but knew nothing of its details. From geometry alone, however, I could state that at 13,500 B. C. the Arctic circles extended to about 54° latitude; that there was a period of about 18,000 years during which extreme cold prevailed in winter down to much lower latitudes than it does at present; and that this extreme climate terminated between 6,000 and 7,000 years ago. This was what geometrical astronomy taught, whilst astronomical theories denied that any such changes had ever occurred.

Being desirous of ascertaining whether geologists were acquainted with any such changes at these dates, I applied to one or two of the then geological authorities, and was informed that during half a million years at least, no such change of climate had occurred. Undeterred by these positive opinions, I published my facts, proofs, and calculations—a piece of daring which caused considerable irritation to the authorities. I stated that geometrical astronomy proved that the Boulder Period lasted only about 18,000 years, and terminated about 7,000 years ago, and that the solution of the cause and the date need no longer be a mystery. Fifteen years after I had given my proofs, during the whole of which time geologists clung to their belief as to 160,000 years or more having elapsed since the Ice Age, a revolution occurred in geological theories. It was discovered that geological facts proved that the Ice Age had lasted not longer than from 15,000 to 25,000 years, and terminated not longer than 7,000 years ago.

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Then came one of the most remarkable expressions of opinion. It having been denied that my calculations could be accurate, because I gave the above dates, it has been lately stated that the recency of these dates renders it impossible that the Ice Age can be accounted for by astronomy. The actual facts are that geometrical astronomy proved these dates twenty-two years before geologists imagined it possible that these dates were even approximate.

When first I gave the results of my investigations, I confined myself almost entirely, so far as geology is concerned, to showing the cause and giving the dates of the last Ice Age. Numerous other investigations have since taken place, many of which are of importance.

The movement of the earth hitherto vaguely and incorrectly described as "a conical movement of the axis around the Pole of the Ecliptic as a centre," proves to be a second rotation of the earth, which causes the two half-axes of the earth to describe cones during about 31,600 years. The Poles of this second rotation are now 29° 25′ 47″ from the Poles of daily rotation, and hence, under present conditions, there would be a variation of 12° in the extent of the Arctic circles during each second rotation.

The position now occupied by the Pole of second rotation is undoubtedly due to the position which the centre of gravity of the earth occupies relative to the earth's centre. The enormous preponderance of land above the sea in the Northern Hemisphere indicates that the centre of gravity of the earth is north of the equator, and probably is not equidistant from the surface of the earth near the equator. Under these conditions we find the second rotation occurring with a radius of 29° 25′ 47″.

Geologists show that this relative distribution of land and water was not always the same. Continents have risen, others have been submerged, the waters of the ocean have necessarily been transferred on the earth's surface, and the centre of gravity of the earth has consequently been slightly altered in position.

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Those persons who have studied the movements of a rapidly rotating gyroscope must know that even the smallest weight, such as a pin, placed on the gyroscope, will cause the rotating axis of the gyroscope to change its direction very considerably. So also the slightest alteration in the position of the centre of gravity of the earth would alter the position of the Pole of second rotation, and hence would alter considerably the radius of the circle traced by the Pole of daily rotation.

In chapter 17 of my book, "Untrodden Ground in Astronomy," this question is more fully dealt with, and need not, therefore, be explained here.

It is probable (and geology seems to indicate) that the present radius of second rotation was reached slowly, and not by a sudden movement. There probably were one or two previous second rotations, with a less radius than that which is now occurring. Consequently there would be temperate intervals between two glacial intervals. It is also probable that, previous to the Ice Age, the radius of the second rotation had never been as great as it is now, and there had been no conditions suitable for the accumulation of vast masses of ice in Polar regions. We owe much of our cold now to this accumulation of ice.

If the heat of the summer's sun was sufficient to melt all the ice formed in the Polar regions during one winter, there would be no accumulation of ice annually. If, however, the summer sun failed to melt all the ice formed in winter, and left only one inch of ice over the earth's surface, then after a period of 18,000 years there would be 1,500 feet of ice covering the land. A most important question therefore is, whether at present the ice in Arctic regions is increasing or decreasing. Is all the ice formed in winter melted in summer, or is more formed in winter than is melted in summer?

Ever since the earth has rotated on its axis, it must, as a mechanical law, have had a second rotation. During the formation of the coal beds the radius of this second rotation must have been very small; the Pole of the Heavens during one part of its course might be very close to the Pole of the

Ecliptic (see chap. 17, "Untrodden Ground"), and an uniform temperate climate would prevail. Then, as the Pole was carried round by the second rotation and became separated from the Pole of the Ecliptic, summer and winter would be distinctly marked, each seam of coal, with its intermediate deposit of sandstone and shale, indicating one complete second rotation.

To jump at the conclusion that because the radius of second rotation is now 29° 25′ 47″ it must always have been so, indicates a singular absence of knowledge, even of dynamics. In the Solar system we find the Arctic circles on Jupiter extending only about 2° from his Poles, while on Uranus these Arctic circles extend about 75°. It seems, therefore, that there is nothing against the laws of the universe in the fact that the axis of a rotating planet is inclined at any angle to the plane of its orbit.

The mystery of the Ice Age has been kept a mystery, in consequence of the positive but incorrect assertions of theorists. A geometrical investigation of the movement of the earth proves that an Ice Age must have occurred, that it commenced about 24,000 B. C., reached a maximum at about 13,500 B. C., and terminated about 7,000 years ago. If the science of geology had not yet been known, it could be stated that an examination of the earth's surface would reveal the evidence of an Ice Age at the dates given above.

The science of geology has hitherto not only received no support from astronomy, but the facts of geology have practically been contradicted by the theories of astronomy. The result has been that men with vivid imaginations have set to work to invent numerous speculations, in the vain hope of guessing the solution of the riddle of the Ice Age. All the time, however, the solution was before them, but was overlooked or ignored, because accepted theories asserted that it could not occur.

To analyze a curve by geometry is not a theory, it is an accurate proof. If I state that the altitude of the Pole is always equal to the latitude of the place of observation, I state a fact. When a person terms this fact "a theory" it

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at once indicates that this person is unacquainted with even the elementary laws of geometrical astronomy, and does not know the difference between facts and theories.

When theorists who deny the correctness of those proofs which I have given are able to accomplish any one of those calculations referred to in Admiral de Horsey's letter, their opinions may be worthy of consideration; but as such calculations are quite unknown to them, and they at the same time state that astronomy can give no explanation of the facts of geology, I fear I cannot accept their theories as infallible, or even true.

The reader who comprehends the movement of the earth herein described, and perceives how it proves the conditions, and gave, twenty-two years ago, the date of the Ice Age, may note with interest, and perhaps amusement, the fantastic theories put forward in books, and before scientific societies, as assumed causes of the Ice Age. If he be a practical man he may be puzzled to assign a reason for the extraordinary care taken to avoid any reference to that movement of the earth hitherto but vaguely defined, which, when accurately known, explains the true cause of the Ice Age.

DIAMONDS AND GOLD.

ANGLO-SAXON SUPREMACY IN SOUTH AFRICA.

1814–1894.

By Major F. I. Ricarde-Seaver, F.R.S., Edin.

The great Napoleon was wont to exclaim that British gold was often a more potent factor in deciding the destinies of European nations than the largest armies led by his ablest generals.

Whether the covert charge of bribery contained in these lines be true or not as against British policy and the power of gold in the past, is not our purpose to discuss; nor is the further doubtful compliment by the same great military genius that England was a nation of shopkeepers deserving of more attention. The difference, however, between the imperial author of those scathing sarcasms and their recipients amounts simply to this—the mission of the one, however unintentional, seems to have been to sterilize and destroy; whilst that of the others, though reprehensible sometimes in the means employed, was to procreate and build up.

I take the foregoing simply as texts in my endeavor to illustrate the far-searching influence of the great elements, Gold and Commerce, as all important factors in the colonizing attributes of that heterogeneous compound ycleped the Anglo-Saxon race. The truth of this is nowhere more fully exemplified than in the "scramble for Africa," which has become, during the past two decades, the great bone of contention amongst European powers.

This is doubtless mainly due to the fact that the "Dark Continent" is the last on the face of the globe which offers a free field to the ever restless and seething populations of the Old World to build up new empires, and satisfy that insatiable desire for adventure and discovery which to-day prevails amongst Englishmen with perhaps deeper intensity than

even reigned amongst the Spaniards and Portuguese in the sixteenth century.

The "unknown" is ever to human nature at large far more attractive than even the positive knowledge of untold treasure obtainable on fixed conditions, however reasonable; and in the opening up of new countries, nothing offers greater incentives than the supposed existence of gold and precious stones. No reasonable amount of capital supplied by private enterprise would or could suffice to bring about the conquest and settlement of a country, such as Africa, without the aid of that universal spirit of adventure, indomitable courage and perseverance, which characterize our race throughout the world.

Thus it was that nearly a century ago, and long before the discovery of the vast mineral treasures which to-day make South Africa the centre of attraction, our ships in legitimate warfare descended upon the Dutch settlements at the Cape, and planted that grain of British millet seed which took root in the extreme south, and subsequently spread and multiplied, until to-day the once mystic and dreaded Zambesi and Tanganyika form a mere geographical expression in defining its limits nearly two thousand miles to the north. What was then a mere speck on the map of Africa, occupied and held by our naval forces in constant expectation of attack from the warlike Kaffir tribes and discontented Dutch settlers, can boast to-day a flourishing city, the seat of a powerful government, a constitutional Parliament, possessing the fullest "Home Rule" attributes from the people, a fount of education and refinement making its influence felt over millions of freemen. These, having rescued from barbarism innumerable hordes of savages, have forged for them the valuable and useful implements of labor to spread our civilization from the Cape to the Equator.

As these latter developments have come about within the last ten years, it may be fairly asked to what influence and to whom is this era of rapid progress due? To those who have followed the course of recent events in South Africa the answer is simple and not far to seek. The "in-

fluence" is gold and diamonds; the "whom" is Cecil John Rhodes. Here we have Napoleon's axiom verified in principle, as applied to Gold *vs.* Armies, but differing totally in its application and results. For, although in the present case British gold was the keystone in building up and starting the vast machine constituting that power-generator essential to extract the hidden treasures of the earth, it not only has been repaid, but goes on producing, from apparently inexhaustible sources, that wealth and civilization which insure the stability of nations.

The first great impetus given to South African development was in 1871, when the now celebrated Kimberley Diamond Mines were discovered. As is usual in such events, all classes and conditions of people rushed to the fields. Separated as Kimberley is by a distance of over six hundred miles from Cape Town, with, at that period, no railway or more rapid conveyance than the Dutch ox-wagon, with its team of eighteen often attenuated bovines, it required thirty days to reach it; now the journey takes thirty hours. Population or town there was none, and that desolate plain on the northern fringe of the great karoo desert, with no fuel, no water, and little grass for the oxen, did not at first sight either invite or realize the dream of an El Dorado.

The spot where the first diamonds were found is about fifteen miles from the Vaal river, the only permanent source of water supply in the district. The diamondiferous formation is unique in the annals of geology, and presents one of the most interesting problems to the scientific mind. Indeed, whether its origin, or that of the auriferous conglomerates forming the great gold belt of the adjoining Transvaal, whence the precious metal is being now extracted at the rate of about $34,000,000 a year, is the most difficult problem to solve, is a question too intricate to discuss here. But, as the miners say, "We care nothing for the origin, so long as we get the diamonds and the gold, and can win them at a profit;" and they are right, from their standpoint.

At Kimberley, and indeed in the adjoining Orange Free State, wherever the formation exists, the diamonds occur in

what is termed "blue ground," which on the surface has been oxidized and decomposed, forming what the diggers term "yellow ground." This latter often extends to a depth of seventy feet; but the source or origin is similar to the blue, and, *a priori*, would seem to be a mud geyser or volcano, or a series of them scattered over the plains. They are numerous, and vary in diameter from a few feet to several hundred. They go down between surrounding masses of basalt, melaphyse, quartzite and karoo shales, widening out as they descend. The surface yellow stuff is soft and friable, and easily decomposed and washed, whereas the "blue" proper is, on extraction from the mine, a hard, compact rock of semi-crystalline appearance; grayish-blue in color, and holding the diamonds firmly imbedded. It is in reality a fine conglomerate, the cementing matter being what may be called, for brevity, volcanic mud, which binds the pebbles of heavy gravel, really larger than beans. This compact blue is blasted from the mine, and spread out on "floors" for a period of four to six months, exposed to the oxidizing influences of the weather, and aided in ripening by occasional watering and "harrowing," so as to expose fresh surfaces. This is called the "weathering process," and seems to answer well, but necessitates the "lock up" of a large amount of capital, and permits of thefts of the larger stones by the Kaffirs, to the extent of over $1,000,000 a year.

The weathered blue is next taken to the rotating washing machines and reduced to pulp; then, by careful pulsating, sizing and concentration, the resulting gravel is obtained clean and spread out on tables, where the diamonds are picked out by hand.

Here again is theft, and although the work is done mostly by convicts lent by government, and kept under strict prison surveillance by white overseers, it is found that many of the best stones are swallowed by the Kaffirs, to be subsequently sold through accomplices to contraband dealers. Many are detected in the act of swallowing the stones, and are at once relegated to a "special" department of the works under the direction of an experienced doctor well versed in the science

of cathartics. Here they are dosed and placed on an elevated "*chaise percée*," with the result that in a few hours the stones are digested, and find their way into the general stock in the strong room, while the thief is punished by bread and water diet and deprived of certain luxuries.

In the first years of diamond digging the system of working the deposits was naturally primitive and costly. Open cuttings from the surface yielded for the time being all the ore required, and the mines were divided up into many thousands of claims, each of nine hundred and sixty-one square feet, worked by numerous companies and individuals.

This went on until a depth of five hundred feet was reached, when heavy rock slips or fallen reef matter practically stopped all profitable extraction of diamonds. Then it was that some enterprising capitalists, advised by daring engineers, started to sink commodious vertical shafts in the barren rock adjoining the "pay shoots." When these reached a certain depth, cross-cuts or tunnels were driven horizontally into the blue, far below the bottom of the open cutting on the surface, and the ore was thence hauled out by powerful engines, as in coal mines. This system, of course, required large capital, and became prohibitory to the ordinary digger. And here for the first time came into prominence the administrative and other abilities of Cecil John Rhodes, as organizer and chairman of the De Beers Consolidated Mine.

The younger son of a country parson in England, he was born forty years ago, and sent at an early age to Oxford, where, his health failing, he was ordered to try South Africa to save his lungs and life. Arriving in Natal, he learned that an elder brother was engaged in diamond digging at Kimberley, and the dry climate of that place being admirably suited to him, he at once "trecked" there.

Thus began his connection with South Africa and the great diamond industry, which by his energy and skill he has converted into one of the most profitable in the world. In this he was ably seconded by his associate and colleague, Mr. Alfred Beit, who is to-day one of the leading merchant millionaires of London.

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The whole of the mines, large and small, of the Kimberley district which showed payable blue, were taken over by him and his group and converted into the great De Beers Consolidated Mine, having a capital of £3,950,000 in shares, and £4,000,000 in debs., the present market value of which in Europe is nearly £18,000,000. They employ eight thousand people, and pay away in salaries and wages over £1,000,000 annually. They win diamonds to the gross annual value of nearly £4,000,000, and pay dividends of 25 per cent.

This great enterprise is managed by an eminent American engineer, Mr. Gardner Williams, who is ably seconded by his countryman Mr. Louis I. Seymour, besides various chiefs of departments, nearly all hailing from Columbia. It is no mean tribute to the capacity of Americans when we see them thus called upon to govern a vast corporation of purely European interests. These gentlemen were chosen by Mr. Rhodes to execute his plans, and no better choice could have been made.

Here it was, at Kimberley, that he also conceived his great schemes of British supremacy in Africa, and matured his plans so successfully that to-day he is not only Prime Minister of the Cape Colony, but the real arbiter of the destinies of South Africa from that capital to the Zambesi.

A man of strong will, knowing what he wants—the great secret of success in statesmanship—with a powerful mind, broad and far-seeing, gifted with a species of magnetism having the force of individual attraction, he draws round him the men of talent and influence of the country, utilizing their political, social and commercial status to further his aims in bringing about the great ambition of his life—a united Anglo-Saxon South Africa.

This, needless to say, is no light task; for, notwithstanding his great power of wealth—a millionaire at least—and the vast ramifications of his influence, he has to deal with a mass of such heterogeneous elements, from the rampant imperial Britisher to the Colonial-born Independent on the one hand, and the Boer or old Dutch element, forming the governing classes of two neighboring independent republics,—the Trans-

vaal and Orange Free State,—together with the native black races, on the other hand, that the problem is not one that any ordinary mortal would care to solve.

But to such a mind as his, the greater the obstacle the more zest it possesses, and when we briefly review what he has done since 1888 towards the attainment of supremacy for the Anglo-Saxon race in South Africa, it may be reasonably predicted that he will eventually attain his ends.

A glance at the map will show, better than any description I could offer, the enormous strides made by us in the acquisition of territory within the past five years.

When, in March, 1889, I published in the *Fortnightly Review* the first article which had till then appeared in the English press, advocating the granting of a royal charter in the "Sphere of British influence in South Africa," our domination north of British Bechuanaland amounted practically to a simple geographical expression. In the autumn of that year, Lord Salisbury granted to Mr. Rhodes and his colleagues, the Dukes of Fife and Abercorn, Lord Gifford, V. C., and Mr. Albert Grey, a "royal charter" empowering them effectually to occupy, administer, and govern the whole of the territory including Mashonaland and Matabeleland, and comprised between the Limpopo River on the south and the Zambesi on the north.

In the month of June, 1890, a pioneer expedition numbering barely one thousand men, composed entirely of volunteers from the Cape Colony and the Transvaal, started from Kimberley, and after a weary "treck" of three months, the greater part through hostile country teeming with armed Zulu tribes of the best fighting stuff in Africa, arrived at the spot marked on the map to-day by the flourishing town of "Fort Salisbury," and this without firing a shot or the loss of a single man.

Nearly three years' peaceful occupation, prospecting, mining, and opening up valuable auriferous reefs, erecting stamp mills and founding three important townships, marked an era of progress rarely equaled even by the great American pioneers of the West.

Then, in July, 1893, came the rupture of friendly relations with the great Matabele chief, Lobengula, who sent in powerful and numerous "Impi" of his dreaded Zulu warriors, ostensibly to punish some inoffensive Mashona tribes whom he claimed as his "slaves and dogs," but really to try conclusions with the white invader. I shall not enter into details of the origin of this, or of the events that led up to it, as doubtless the facts are familiar to most readers in America as well as in Europe.

I may simply say, that, within the space of two months from assembling his force of barely a thousand volunteers, Dr. Jameson, the able Administrator of the chartered territory, not only broke up the dreaded military power of the Matabele, but practically annihilated their armies of over 20,000 warriors, occupied their great kraals, and drove their king from his capital to die two months later in the desert.

Thus the beginning of 1894 witnessed the absolute annexation to Great Britain of a territory in Africa as large as France and Germany, fertile and healthy to a degree, on the high plateaux of four thousand to five thousand feet elevation, while the discoveries of gold and other metals daily announced tend to confirm the belief that this is at least one of the sources whence the Queen of Sheba drew her offering to King Solomon.

To Mr. Rhodes is due the initial conception, the planning and the execution of this vast scheme of annexation, and the final subjugation of the native tribes.

Turning from the sphere of British influence in the North, let us glance for a moment at that wonderful little Dutch Republic of the Transvaal, whence the world is now deriving its principal supply of the precious metal. Ten years ago this territory was still practically regarded by Great Britain as the "howling wilderness" it had been described by a former Governor and High Commissioner of the Cape Colony, when ordered to report to the home authorities on its value and prospects. True, some isolated and intermittent quartz reefs had been found, holding gold in fair quantities, but

regarded as hardly workable under the conditions of transport and labor which then prevailed.

The vast auriferous beds of conglomerate of the Witwatersrand had not yet been discovered, or, more properly, had not been recognized by experts as worthy the attention of capitalists or diggers.

The great London house of Rothschild, having heard of their existence, appealed to their United States correspondent to send them the best mining engineer in the country. The same Mr. Gardner Williams who to-day so successfully directs the great De Beers Diamond Mines at Kimberley was chosen for the post. Few men of his age had had more experience of auriferous formations in the Western States of America. Coming with the highest credentials and recommendations, he was dispatched to Africa. He visited the Transvaal, and traversed from east to west some of the finest grazing and agricultural lands in the world. He descended the few shafts then sunk on the quartz reef of Barberton and De Kaap, away on the eastern border, and adjoining the Portuguese territory of Delagoa Bay. He examined the patches of alluvial found here and there in the valleys contiguous to these, but, accustomed as he had been to the rich and extensive gold placers of California, he came away disgusted, marveling at the credulity of the Old World bankers, and finally condemned the district. Then he wended his weary way across the veldt toward the west *en route* to Kimberley, taking the then recently discovered "banket" formation at the Witwatersrand on his way. Here he saw those marvelously regular beds of conglomerate, often erroneously designated as "reefs," lying in bounteous profusion over an area of seventy by forty miles. Their thickness ranged from two to twenty feet, and presented all the characteristics of having once formed the beds of inland seas.

Never in the experience of man had such formations been known to contain gold, and hence it was quite pardonable on the part of Mr. Williams to pooh-pooh them as auriferous. True, he saw some pannings of the ore made by what he conceived to be poor deluded ignoramuses, and when infinitesimal

particles of "color" (*i. e.*, gold), showed themselves on the bottom of the pan, he philosophically shrugged his shoulders and rode away, exclaiming, "It was not worth while dismounting to look at them." Alas for human fallacies! These once despised beds are to-day the source of untold wealth, and producing gold at the rate of $40,000,000 a year.

The bleak and uninviting veldt of that year is to-day the site of the populous and thriving city of Johannesburg, numbering over forty thousand souls.

Over two thousand heads of stamps are thudding away day and night along the line of outcrop for a distance of forty miles. Millions of tons of the despised "banket" are being crushed, and the precious metal extracted by amalgamation, chlorination and cyanide of potassium, to the tune of over two million ounces a year, worth $34,000,000.

This vast industry—forty mines alone of which are capitalized at $95,000,000—has in ten years transformed the whole country, politically, socially, and commercially, from a bleak, impoverished cattle-range into a veritable El Dorado.

The technical direction and organization of this vast human bee-hive is under the control to a great extent of four of the most distinguished American engineers I know, Messrs. Jennings, Butters, Perkins and Hammond, while Messrs. Fraser and Chalmers, of Chicago and London, have supplied a large proportion of the machinery at work.

The Boers who, in 1847, dissatisfied with British rule in the Cape Colony, "trecked" across the Vaal River (hence the name Transvaal), conquering inch by inch from the warlike natives this then purely pastoral territory, never dreamed of the mineral wealth it contained. And indeed when gold was first discovered in 1873 they did their utmost to prevent its development by the "outsider," in the dread of being "crowded out" again and having to "treck" still further north. At that period the country was an independent Boer Republic, but in 1877 it was annexed under the British flag. But the sturdy Dutch burgher "loveth not the red coat," and

hates the Imperial Britisher with all the energy and intensity engendered by radical enmity during generations of conquest. They rose up sturdily in rebellion, and in 1880 drove out their hereditary foes, inflicting upon the British arms one of the most ignoble and disastrous defeats recorded in the annals of our time. Of course, had the Imperial government decided to reconquer the country and put forth its irresistible might against a handful of burghers, it could have done so; but Mr. Gladstone, in the magnanimity of his heart, and with that admiration he professed for the principles of Home Rule, decided to let the Boers keep their country, and so it has become the flourishing "South African Republic" of to-day.

For some years after its independence was secured, the struggle for existence was acute. Resources were few, exports less, and the result an empty exchequer. Isolated from the coast by the Portuguese on the east, the Cape Colony and Natal on the south, and German Damaraland on the west, its means of communication with the outer world were reduced to almost *nil*. Railways were a dream of the very dim and distant future, and the dreary ox-wagon, with its forty days' pilgrimage to Cape Town, was a nightmare too terrible to endure.

What then does not the Dutch Boer owe to the discovery of gold in his country? Wealth, prosperity, and power as a political factor in the South African family of states. Railways, telegraphs, electric lighting, fine cities, cheap articles of every-day consumption, an enlightened and free press, schools, churches and lawyers galore, and above all a large surplus revenue.

Governed by a remarkable man in the person of President Paul Kruger, an astute statesman, endowed by nature with a will of iron, a shrewd politician and a keen penetrating judge of character, the country has been raised from the insignificant status of a petty, impoverished province to that of a powerful and respected nation. Uneducated in book lore, to a degree inconceivable in the chief of a state, Kruger has had the good sense to associate with him in the government as his Secretary of State a refined and educated Dutch

gentleman. In Dr. Leyds, as a young law-student in Holland, the President saw, during one of his visits to Europe, the making of the future man he wanted at his elbow; and on terminating his studies, Dr. Leyds was engaged to proceed to the Transvaal as Attorney-General. So young was he that he had to wait a certain time at the capital, Pretoria, before, according to the Constitution, he became eligible for the post. To-day he is one of the ablest and shrewdest statesmen in South Africa, and he and Paul Kruger, his chief, combined, are a close match for the astute and brilliant premier of the Cape Colony.

Numerically the Dutch Boer element in the Transvaal is far inferior to the Anglo-Saxon, the Teuton and others, but politically they govern and administer the country with a firm and authoritative hand. It is a curious anomaly to see at the end of the nineteenth century a minority of fifteen thousand burghers, all told, ruling a majority of sixty thousand enlightened, wealthy and prosperous aliens, who, although they possess the richest and most valuable portion of the country, have no voice in its government. Not only is this so as regards legislative function, but, incredible as it may appear, these aliens are still deprived of even the ordinary municipal functions which obtain in the most insignificant town of the United States. Over and over again have the forty thousand white inhabitants of the golden city of Johannesburg clamored in vain for a municipal charter to enable them to improve and beautify their own creation.

But President Kruger and his government wrap themselves in their Constitutional toga of centralization, and hurl forth from the Capitol the monotonous cry of "*Non Possumus!*" From their point of view they seem justified, however unreasonable, in this refusal, because they know full well that a municipality, such as would be established in Johannesburg, might soon become a formidable and dangerous *Imperium in Imperio*, eventually assuming the higher functions of the State.

But this puerile policy of the few cannot long prevail against the overwhelming will of the many, and the day is

not far distant when the power of wealth, prosperity, and numbers must, in the logical and natural course of events, assume its proper place in the legislative and administrative affairs of the country. The franchise must be extended to all those duly qualifying for citizenship; and, when this is done, the "*Uitlander*" as a class, now dreaded by the Boers, will cease to exist. They will become citizens on an equality with the burgher of to-day; and a peaceful and bloodless revolution will come about, placing the control of the State in the hands of the majority; or, in other words, the Anglo-Saxon race.

Thus the gold which came as a boon and a blessing to raise the patriotic Boer from poverty and misery and save his nation from bankruptcy, may soon be regarded by the "Dopper," or old Covenanter class, as a curse, since its influence and its consequence may once more relegate them to the hated domination of their hereditary enemies.

THOMAS PAINE, AND THE REPUBLIC OF THE WORLD.

By Moncure D. Conway.

"This day was published, and is now selling by Robert Bell, in Third Street, price two shillings, 'Common Sense,' addressed to the inhabitants of North America." So ran an advertisement in the *Pennsylvania Journal*, January 10, 1776. The pamphlet reached Washington at Cambridge shortly after the British outrages in Maine and Virginia, and from the leader of a Rebellion he rose the defender of a Revolution. On January 31, just three weeks after the pamphlet was published, Washington wrote to Joseph Reed, "A few more of such flaming arguments as were exhibited at Falmouth and Norfolk, added to the sound doctrine and unanswerable reasoning contained in the pamphlet 'Common Sense,' will not leave numbers at a loss to decide upon the propriety of separation." To convert Washington was to found a nation.

Yet the argument for Independence was only a subordinate part of the service rendered by this wonderful pamphlet. It carefully demonstrated the necessity of a union of the colonies under a purely Republican Constitution; and so vividly, with such ample knowledge of the resources of the country, was this Republic described and adorned, that it held all eyes, as if some jasper-walled city, with gates of pearl, were descending on the New World. Paine's subtle imagination built up a navy out of the continental tar, timber, hemp; picturing argosies of commerce transformable in a moment to fleets of defence, bristling with arms manufactured from American iron, which is "superior to that of other countries." In his vision grew a national union out of the "intimacy which is contracted in infancy, and the friendship which is formed in misfortune," not only sectional but sectarian jealousies van-

ishing before the liberal principle which regards all denominations as "children of the same family, differing only in what are called their Christian names." Our first Attorney-General, Edmund Randolph, the most scholary and literary statesman of the time, described Paine as "possessing an imagination which happily combined political topics, poured forth in a style hitherto unknown on this side of the Atlantic, from the ease with which it insinuated itself into the hearts of the people who were unlearned, or of the learned." Although the pamphlet was first issued at two shillings, Paine speedily gave up all copyright advantages by putting it on the market at the exact cost of manufacture, so that it was read by every person able to read. The Republic was thus built up in every individual mind, and when the Revolution was over it was found that monarchy had been relegated to antiquity.

Paine was now the lion. Amid the first festivities of peace Washington invited him to his camp at Rocky Hill, and insisted that Congress should make provision for the heroic author, declaring that otherwise he would do so out of his own pocket. Congress presented to him a fine estate near New York, and Pennsylvania gave him five hundred pounds. Paine had settled himself at Bordentown, New Jersey, where he perfected his invention of an iron bridge, but he occasionally visited Philadelphia and New York, and in each place was the centre of the finest social circle. He received the homage of Washington, Franklin, Jefferson, Madison, Adams, Randolph, Burr, Clinton, Dickinson, Reed, Rittenhouse, Rush, Clymer—in fact, of all public men. In 1787 he sailed for France, and submitted to the Academy of Sciences his iron bridge, which received the applause of that body. In Paris he was welcomed by Jefferson and Lafayette, by all of Franklin's friends, and enjoyed the friendship of Condorcet, Brissot, Danton, Duchâtelet, De Brienne, Neckar, De Corney, and others. Passing over to London, he was even more lionized. Edmond Burke entertained him at his country seat, Beaconsfield, and drove him about many pleasant by-ways. Lord Lansdowne, the Duke of Portland, Fox,

XUM

Lord Fitz-William, the Marquis of Rockingham, Sir Joseph Banks, Sir George Staunton, and the American artists, Benjamin West and Trumbull, were among those who gathered around him.

To such position, in 1787, his fiftieth year, had climbed, by sheer intellectual power, the man who began as the son of an humble Quaker and staymaker, of Thetford, England. Up to the year 1792 no man in the world bore a higher character or enjoyed such wide literary fame. At the close of 1792 he was outlawed in England; at the close of 1793 he was imprisoned in France; and in 1794 America joined in the hue-and-cry which hounded Paine to his grave, and made him the third person of a diabolical trinity, "The world, the devil, and Tom Paine," as the hymn ran. It was suddenly discovered that the man who had received the gratitude of Congress, enjoyed the friendship of every statesman in America and France, and of the greatest in England, had all along been a black-hearted villain, a drunkard, a blasphemous wretch. This discovery was made in England immediately on the publication of Paine's "Rights of Man," and in America on the publication of the "Age of Reason." Paine's diabolism was an evolution out of the necessities of Church and State. It was politically inadmissible that a man who ridiculed Royalism could be other than a demon, however disguised in benevolence; it was theologically inadmissible that a deist could be other than an immoral man. If the facts did not confirm these reasons of state and of sect, so much the worse for the facts; such perverse facts were promptly corrected and adapted to pulpit and parliamentary utility. A vast Paine mythology was thus accumulated.

But the mental and religious conditions out of which that mythology was developed have disappeared from educated Christian society. Only a vulgar and illiterate sectarian could now suggest that an Emerson or a Darwin must be a bad man because not orthodox, or believe any story of deathbed agonies of remorse suffered by freethinkers. In recently writing the life of Paine, I received furtherance from eminent clergymen, and the evidence given in that work, overthrowing

the Paine mythology, and proving the author to have been worthy of the friendship he received from the best men of his time in America and Europe, has been fairly accepted. Paine being now released from his pillory, the tar removed, we can see the man as he really was, and consider the principles he announced. It is necessary, however, to limit the scope of this paper. For the personal character of Paine, and his strange career in America, England, and France, the reader must be referred to his biography just published. Concerning his religious work, I will here only say that he was the first to use the phrase "Religion of Humanity," and that he founded (in Paris) the first church based on love of God and Man (Theophilanthropy). What I now propose to dwell on is his ideal political order, the peculiarities of which, little known or appreciated, are of present philosophical interest.

Samuel Rogers, the poet, relates that at the age of twenty-nine he dined at the table of an eminent radical in London, then much agitated by the dawning French Revolution, one of the humorous toasts given being to "The memory of Joshua," for having executed the kings of Canaan. Paine observed that he would not treat kings like Joshua. "I'm of the Scotch parson's opinion," he said, "when he prayed against Louis XIV., 'Lord shake him over hell, but don't let him drop.'" Paine then gave as his toast, "The Republic of the World." Young Samuel Rogers was impressed by the "sublimity of the idea," but probably few present at the table comprehended the full significance of those words in the mind of Paine. His Republic is one which has never existed even unto this day.

The foundation of Paine's Republic had been laid in his Quaker principle—the immediateness of the relation of the individual soul to the divine Spirit. The sweeping away of all sacerdotal and sacramental mediators by George Fox found its political corollary in the clearing away of all royal or other prerogative rank and privilege by Thomas Paine. The doctrine of the divine light in every human being involved equality, and it also carried a subtle revolution in

the ideas of man's nature. Instead of human depravity, human divinity was affirmed. The fatherhood of Satan fell before the fatherhood of God, whose light enlightened every man. In the presence of this essential and awful dignity of man as man, the artificial distinctions of courts shrivelled away. Such were the seeds that Penn and others had scattered abroad in the New World, and the reaper of that harvest came from a tiny Quaker meeting-house in Thetford, where he listened reverently to the utterance of the humblest workman as to the voice of God.

This politico-religious republicanism is not merely fatal to hereditary and ecclesiastical privilege, but equally to democratic privilege—that of majorities. It rests upon the equal rights of every individual child of the Father of All, and the majority has no more right to oppress a minority than a strong man has to oppress a weaker one. The limited rule of the majority is not only inevitable, but has a rational basis in the presumption that it represents the larger quantity of benefit. But in forming a community, or organizing a nation, each individual is concerned to limit the power of the majority, since he himself may at some time be of the minority. In order, therefore, to secure individual liberty people meet together, apart from official interests and partisanship, in a convention, comprising the representatives of all, chosen for the sole purpose of framing a compact of the people with each other, defining the natural rights of man, and limiting the functions of their common government, so that it should never, by whatever majority, encroach within the sacred circle of individual rights. "By this mutual compact," to quote Paine's words, "the citizens of a Republic put it out of their power, that is, they renounce as detestable the power of exercising, at any future time, any species of despotism over each other, or doing a thing not right in itself, because a majority of them may have strength of numbers sufficient to accomplish it. In this pledge and compact lies the foundation of the Republic; and the security of the rich and the consolation of the poor is, that what each man has is his own, that no despotic sovereign can take it from

him, and that the common cementing principle which holds all the parts of a Republic together secures him likewise from the despotism of numbers, for despotism may be more effectually acted by many over a few, than by one over all."

Republican government is thus rigidly restricted to the functions which have been assigned it in later years by Herbert Spencer, Wilhelm von Humboldt, and John Stuart Mill, who have largely repeated Paine's arguments. The functions of government are simply to secure the whole nation from foreign invasion, and to secure every citizen from invasion of his rights by another citizen, or by any combination of citizens—a town, a county, a State, a majority. A government really republican could have nothing whatever to do with a man's opinions, religions, beliefs, unbeliefs, habits, nor even with his morals, his vice, or his immorality. It can take notice only of the individual conduct which demonstrably and calculably injures another, or others; that is, only of crime. In forming civil and political society by constitutional compact, the individual does not part from any of his natural rights, but he concedes his own separate control over the exercise of some of them in order to obtain from the community protection of those rights. The rights reserved entirely to the individual are such as he has full power to execute alone; the rights confided to the community are those in which his power of execution is defective. "A man, by natural right, has a right to judge in his own case, and so far as the right of the mind is concerned he never surrenders it; but what availeth him to judge if he has not power to redress? He therefore deposits this right in the common stock of society, and takes the arm of society, of which he is a part, in preference and in addition to his own. Society *grants* him nothing. Every man is a proprietor in society, and draws on the capital as a matter of right."

These securities depend on equal representation. If a man's will is liable to be overruled it must be by a power to which he has consented. Every man must have a vote. Paine describes representation as the "delegated monarchy of a nation;" from which we may infer that he did not consider

the representative a mere delegate of the instructions or "programme" of his party among the electors, or even of his entire constituency. The representative is supreme in the republic; he represents the whole nation; he has to form wise and just opinions in consultation with the various and collective wisdom of the nation. The representative body of a republic is purely elective, and one only; but Paine would divide it by lot into two parts, sitting in different rooms, and alternately introducing bills. While Division A discussed the proposed measure, Division B would listen, learning the facts and arguments without being committed to either side. Should A pass the measure, B would bring to it full knowledge and uncommitted judgment. The votes of the two divisions, added together, would determine the matter.

It should be said, however, that although Paine argued that there could not be in a true republic two co-equal legislative chambers with different representative bases, he, by no means, regarded his own scheme just stated as more than a suggestion. He maintained that the science of government was just beginning to be studied and understood.

The republic comprises two departments only—the making of laws and their execution. The law enacted by the legislature passes at once to the courts of law, which direct their execution. All officials are agents of the courts, whether sheriff, policeman, president, or king. By whatsoever name called, the Executive is the Hand, and cannot be raised above the Head—the Legislature, which creates the laws.

In the republic the only sovereign is the Law. In his "Common Sense," when he was more orthodox, Paine proposed that the United Colonies should formally declare their independence, frame a charter of union (a Constitution), and place a crown upon the Bible, "by which the world may know that so far we approve of monarchy, that in America THE LAW IS KING." To the last he was opposed to all supremacy of an individual which would admit of his vetoing a legislative act, or of his originating, with or without the advice of a cabinet, any policy or action not definitely commanded by legislative enactment. He admits that a people

have the right to establish any form of government, provided they include in it provisions for amendment, and do not make any office hereditary; it would be republican in basis even though some monarchical formulas survived in it.

It will be seen, therefore, that although Paine is traditionally supposed to be a revolutionist, he was really the earliest political evolutionist. At his trial in London, December 18, 1792, for his reply to Burke, Erskine pointed out that while Burke's pamphlet left the nation no means of altering their government except violence, Paine's "Rights of Man" provided the means of peaceful reform. Burke was really the revolutionist, though he instigated the prosecution of Paine. In truth, Paine's Quaker principle of peace was as deep in him as his faith in the "inner light," which equalized man with man as to natural rights. Stern as he was in theoretical repudiation of monarchical forms, he foresaw the perils of war in an immediate overthrow of the throne in France, and promptly aided Lafayette in his plan of transferring the throne to a popular basis. Had it not been for the king's fatal flight, the world would have witnessed the picturesque sight of Thomas Paine bearing the Star-spangled Banner in a procession to inaugurate Louis XVI. as a republican king. And even as it unhappily turned out, when the king was on trial for his life, Paine, unmaker of kings, was seen pleading for that life, with such effect that Marat launched himself into the middle of the Convention and cried, "Thomas Paine votes against the death penalty because he is a Quaker!" For once, at least, Marat spoke truly. In England, too, Paine's "testimony" was inflexibly against violent revolution; many facts indicate that it was mainly he who restrained the ardor of his adherents, who wished to deal with kings after Joshua's method. England outlawed as a revolutionist the man who probably saved her from revolution.

Paine's Republic of the World exists only as does the Republic of Letters. Our so-called republics are compromises with survivals of feudalism, and with the love of pageantry, the personal ambitions, inbred by monarchical

ages. Nevertheless, the universal Republic has its citizens, its international aims, interests, occasional assemblies. One sometimes sees the medals struck off in England a hundred years ago, bearing effigies of Paine on the gibbet. They are much valued by collectors; but meanwhile the currency coined by Paine's brain is still in circulation, so familiar indeed that we little remember the furnaces in which they were minted, or recognize the head engraved on them. It was from Paine that we have such phrases as "Rights of Man," "Despotism of Numbers," "Age of Reason," "Religion of Humanity," "The Law is King;" and from him many felicitous generalizations, such as these: "A Declaration of Rights is, by reciprocity, a Declaration of Duties also;" "The splendor of a throne is no other than the corruption of the State;" "Public credit is suspicion asleep;" "A despotic form of government knows no principle but *will;*" "The despotic form of government knows no intermediate space between being slaves and being rebels;" "Time makes more converts than reason;" "Constitutions are to liberty what grammar is to language;" "To be nobly wrong is more manly than to be meanly right;" "The wrong which began a thousand years ago is as much a wrong as if it began to-day; and the right which originates to-day is as much a right as if it had the sanction of a thousand years;" "Religion is man bringing to his Maker the fruits of his heart." In 1826 a dictionary of Paine's aphorisms was published in London (12 mo., pp. 177), which thousands carried in their pockets, and from which were sown far and wide the seeds which have reached their golden harvest in the liberty and civilization of the Victorian reign.

A NEWTON OF THE MIND.

THE PROPELLER OF KEELY'S AIR-SHIP DESCRIBED.

COMPILED BY MRS. BLOOMFIELD MOORE.

Error is not forever; hope for right.
Darkness is not the opposite of light,
But only absence—day will follow night.

LOWELL.

God sends His teachers unto every age,
To every clime and every race of men,
With revelations fitted to their growth.

LOWELL.

In the progress of the race, man may be likened to a little child that is now beginning to totter alone, just escaped from his leading-strings, but with a future of power and intelligence in his coming manhood past all present computation. JOHN SARTAIN.

Nous marchons tous au milieu de secrets, entourés de mystères. Nous ne savons pas ce qui se passe dans l'atmosphère qui nous entoure; nous ne savons pas quelle relations elle a avec notre esprit. VITOUX.

"All the work of the world," says Drummond, "is merely taking advantage of energies already there." In order to take advantage of these energies, we must not only know of their existence, but know the laws which govern their operation in nature; for so only can we conquer them and make them our slaves instead of our masters.

More than twenty years ago, Keely, by seeming chance, discovered the unknown polar flow, and without giving any attention to research, on the line of its origin or of its operation, began to construct engines to apply the energy to mechanics. It was not until he had invented his marvelous researching instruments that his true work of evolution began in 1888, which, completed in 1893, has now borne the test of demonstration and given him command of a vibratory circuit for running machinery, both for terrestrial use and for aerial navigation.

Before this could be brought about it was necessary to effect a sympathetic affinity between his machinery and the polar flow, *minus magnetism*. The colossal nature of the difficulties that he has surmounted can never be realized as by those who have followed him during the last five years, and seen them spring up one after another, at every advance, to bar his way.

Through this system the dynamo will eventually become a thing of the past, and electric lighting will be conducted by a polar negative disc run by a vibratory circuit of sympathetic polar attraction, "drawn direct from space," which Keely has harnessed for commercial use after more than twenty years of maligned and persistent effort such as the world has never known.

Before attempting to set down any of the great truths of sympathetic physics, it will be necessary for the scientific reader to have some idea of Keely's views of "Nature's sympathetic flows." Although he has substantiated his theories by demonstration to his own satisfaction and to the conviction of distinguished men of science, electricians and engineers, he will welcome any refutation of them which shows that he is in error, for Keely does not claim to be infallible, as do those who sit in judgment upon him. To quote from his writings:

"Physicists have been working in the wrong direction to lead them to associate themselves with Nature's sympathetic evolutions. It is not necessary to advance farther into the unexplored region of these sympathetic flows than the ninths, to become convinced that the one I denominate the dominant is the leader toward which the remaining thirds of the triune combination (of triple sympathetic streams) co-ordinate, whether it be the cerebellic, gravital, or magnetic. When we reach the luminiferous track on the ninths, in the triple subdivision, we have proof that the infinite stream, from that unexplored region where all sympathetic streams emanate, is triune in its character, having the dominant as the sympathetic leader, to which the remainder of the celestial thirds are subservient; the

cerebellic being the dominant, and the triplets (gravital, electric, and magnetic) following in its train.

"The magnetic cannot lead the electric, nor the electric the gravital, nor the gravital the magnetic. All are subservient to the dominant,[1] as a train of cars is subservient to the locomotive which pulls it along; the only difference between the two is that one is sympathetic, the other mechanical. Though this is a crude illustration, it conveys a great truth in sympathetic philosophy. All sympathetic flows have this triune condition associated with them, the same as the molecular, atomic and etheric aggregations of all forms of visible matter; the compound etheric, or dominant, being the leader and yet one of the constituents of the molecule itself. The dominant we may call the etheric portion of the molecule; the harmonic, the atomic; and the enharmonic, the molecule itself. The dominant parts of the triune combination of the sympathetic streams are the leaders, toward which all co-ordinate to make up the sympathetic terrestrial envelope of the earth; the cerebral being the high dominant, or compound etheric, the luminiferous proper.

"All diversions from the polar terrestrial envelope are but nodal outreaches, induced by the proper order of sympathetic vibration; not dissociations and associations of sympathy; but operating on the same principle as the outflow, or nodal outreach of the mental organism toward the physical, in its control over it. The latent conditions are in a state of neutrality, as regards action, until the exciter—mental outreach—is brought into sympathetic play. If we dissociate the sympathetic mental from the latent physical, it would be equivalent to beheading it; consequently, the physical would

[1] The mental flow is dominant over all the sympathetic conditions associated with the physical organism. The nervous flow comes under the order of the sub-dominant; consequently there is no sympathetic correlation between the two.

Example: The body of a violin represents the mental, or resonator, while the strings by which it is attuned represent the nervous, or nerves. The strings or nerves, can be brought to a tension whereby they are broken apart, but the violin, or resonator, remains intact and dominantly independent under all these conditions.

cease to exist as a thing of life; but the dominant—the cerebral—would remain in its unchanged form, *viz.*, the high etheric.

"The system of inducing differential harmonies by compound chords is one that the world of science has never recognized; simply because the struggles of physicists, combating with the solution of the conditions governing the fourth order of matter, have been in a direction antagonistic to the right one. By this I mean that physicists reject the true conditions of the dissociation of matter; recognizing and holding fast to an adverse law; debarring the subdivision of the atom, and ridiculing the existence of latent force in intermolecular space. I have substantiated the triple formation of the molecule by the differential triple reply that it gives when excited by compound concordant impulses, and by the accelerated range of motion which it assumes under intensified vibration, even to dissociation from its fellows; proving this dissociation by the increased amounts of latent energy evolved, progressively."

At an early period of Keely's researches, on the lines suggested by the distinguished professor of the Bonn University, Dr. Hertz, *viz.*, of the conditions governing the operation in nature of the unknown energy he was dealing with, Keely wrote to a friend:

"It appears, in my researching experiments, quite evident to me, that under different orders of progressive vibration, when the sixth order is reached on the positive, a condition presents itself in an accompanying agent that adds to the etheric flow a very peculiar action. I call this third agent its sympathetic attendant.

"In the physical organism, the circulatory forces have their attendants in the form of nerves, which are the sensatory telegraphs to all parts of the human system. I have reason to believe that under the seventh subdivision of matter a condition is reached where perfect assimilation takes place between these two sympathetics, thus showing the luminiferous track. It is this assimilation or association that induces the luminosity, I am quite certain; but in this unition

there is nothing approaching corpuscular friction, which in itself is antagonistic to luminosity.

"Consequently the unition of these sympathetic thirds must take place by gravital assimilation, which is the highest order of sympathetic union. *This is the compound etheric flow, or soul of matter. The sympathetic attendant must be the odylic; or, comparatively speaking, its nerve force.* Reichenbach exercises a wonderfully far-seeing judgment in his argument on this, the highest preponderable.

"If I am able, with the instrument I am now constructing, to demonstrate these assertions as truths, it will amply repay the researches of a lifetime. The conditions governing the nerve-force of the planetary system may then be unraveled by future research. This seems to be too immense an aim to be associated with human thought.

"I hope I am the 'compound lunatic' that the scientific world calls me, to whom it is given to work out the demonstration of these 'hidden things of God' which hitherto have seemed to be past finding out. They may call me 'Cagliostro,' 'Impostor,' 'Charlatan,' or anything that pleases them; I shall glory in these names, if I can reach the solution of this vast problem that I am now at work upon. I thank God the time is near at hand when I will be able to prove how faithfully accurate is the new philosophy in showing up the conditions governing the sympathetic field."

By progressive research Keely has, since that time, attained such perfection in his method of work that the vitalizing of instruments, which formerly took him three days, is now accomplished in fifteen minutes, using hydrogen in increasing molecular oscillation to the point where the power can be registered. Up to a certain stage he was able to employ the ether; but in this process it would be as impossible, as it is to take the flow of thought in one's hands and by physical effort tie it in a knot. Having, in these researches, succeeded in wresting from Nature the conditions of planetary suspension, he is now well on his way toward gaining the closely guarded secret of the firefly. All that Nature does with Nature's forces man will be able to do when he has

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wrung from her grasp, one by one, the keys that she still clenches in her hands; for it is Nature herself, not Science, which has given to the world, in this system of aerial navigation, "the crowning achievement of a century of progress."

Keely has never made but one experiment in dissociating the hydrogen of the chemist. After a persistent effort of over seven weeks' duration, in his attempt to confine it and hold it under assimilation with one-third its volume of disintegrated air, he succeeded in obtaining a rather indefinite result, lasting only about ninety seconds. The luminosity shown was the only evidence he had of its dissociation; but, in his process of disintegration of water, he never fails to obtain proof of the triple subdivision of hydrogen—molecular, atomic and inter-atomic.

Each disc of the polar and depolar groupings in the propeller of the air-ship contains seven pints of hydrogen. In preparing these discs, the hydrogen is submitted to a triple order of vibration. The corpuscular envelopes of the molecules are not enlarged in volume, under their receptive condition, but their velocity of rotation is increased. While under the operation of this transmittive vibration their vortex action is made visible.

Under date of November 2, 1891, Keely wrote of one of his researching instruments which he was then inventing, to overcome nodal interference in sympathetic negative outreach: "This instrument combines the disintegrator and the positive-negative-indicator in one. It will be but an intermediate, as between the sympathetic negative transmitter and the depolarizer. At present, I am working like a man suspended between heaven and earth, trying to reach one without leaving the other."

This is one of Keely's many apt figures of speech, which convey, as no other words could, what his position has been in the past. The wonderful instrument (the sympathetic harness) which he has now completed to connect the polar flow with the propeller of the air-ship, substantiates what only two years ago was purely theoretical in Keely's system of sympathetic-vibratory physics; and, figuratively speaking,

proves that without leaving earth he has laid hold of the very battlements of celestial regions, thus opening a pathway for men of science to reach the solution of their most intricate problems. Often has Keely expressed his regret that mechanical physicists have not had suitable instruments for their researches, saying that they would long since have discovered their errors had they been in possession of proper instruments for acoustic research. It was some photographs of his instruments which led the late Henri Hertz, after examining them, to say in 1889:

"No man who is working on these lines, with such instruments, is a fraud. I cannot help him; no one can help him; he must work out his system alone, and when it is completed, we can pursue our researches on the same line. I thought Keely was working, as I am, with an electrical machine and wires. I had no idea of these wonderful instruments."

The machine used by Keely, from 1872 to 1882, for disintegrating water, weighed several tons. Since that time, in his work of evolution, he has made such advances that the one he now uses is no larger than the wheel of a perambulator.

In Keely's process of disintegrating water, the proportion of oxygen to hydrogen is such as to favor the bringing about, under a certain order of triple vibration, the antagonistic differentiation necessary to produce molecular and atomic corpuscular dissociation. When this dissociation takes place, the hydrogen becomes highly rotating, acting like a molecular capsule with the oxygen enclosed. While under this condition, when confined in a tube, they remain dissociated until the peripheral rotation of the hydrogen is interfered with.

One of the foundation stones of vibratory physics is that "no differentiation can exist in the workings of the pure law of harmony." If this be correct, then all so-called elements have a triple basis, as vibratory physics teaches, for the system that represents harmony in one sense must represent it in all, or everything would be brought into "chaotic

confusion." Therefore, as Keely surmised, long before he was able to prove it to his own satisfaction, hydrogen must, under the conditions of this law, be composed of three elements; and these three elements in turn must each have a triple formation, and so on indefinitely, until verged into the infinite inter-luminous.

The correctness of these hypotheses has been proved by the varying degrees of energy evolved in progressive disintegration from the molecular to the introductory etheric. Keely writes:

"The nearer the approach to the neutral centres, when the dissociation takes place, the greater is the latent force evolved. In molecular dissociation the instrument is set on the thirds, meeting with a rotating resistance of five thousand pounds per square inch, without any interference with the inter-molecular position. The instrument is set on the sixths, to liberate inter-molecular latent force, which, when liberated, is equal to a resistance of ten thousand pounds. To reach the atomic centres, the instrument is set on the ninths dominant, the sixths harmonic, and the thirds enharmonic, having the transmittive chord B associated with each. At this setting the corpuscular percussion exceeds twenty-five thousand pounds per square inch. The subservience to the co-ordinate sympathy is shown in the result by a pressure exceeding fifteen thousand pounds, reaching, in this subdivision, almost as near the neutrals as instruments can carry us. The atomic and inter-atomic settings constitute the introductory conditions governing the nodal outreach as toward the etheric. Under this condition of sympathetic vibration an evolution of energy is registered far exceeding any heretofore liberated. The region of the inaudible is reached—the introductory etheric and the first features of the invisible latent force existing in corpuscular embrace have been handled.

"We must put our shoes from off our feet—*i. e.*, lay aside our earthly bodies—before we can go farther. But this is far enough to prove that nothing is lost, and that, when this repellent order of things is brought about, and so-called

elements are separated, these elements yield up, in their molecular separation, what may be called their souls, or more progressive elements.

"We have gone far enough to find that there is no such thing as death; that matter cannot die, any more than the substance or spiritual essence which controls it can die. The word death is a misnomer, for there is only a change of base in the molecular visible, and it is the same with the sympathetic invisible, for celestial radiation claims her own back again to its realm of spiritual existence.

> "'My own dim life should teach me this,
> That life shall live for evermore;
> Else earth is darkness at the core,
> And dust and ashes all that is.'

"It is through the action of nature's sympathetic forces that planets are born and their volume of matter augmented. If the sympathetic, negative polar stream were cut off from the earth, its molecular mass would become independent, and would float away into space as would a soap-bubble filled with warm air. The same conditions of governing rule exist in the planetary masses as between the mental and physical forces in our organisms; the organism representing the earth, and its link with the cerebral centres the connection with the infinite mind. In other words, the latent energy existing in the neutral depths of matter, visible or invisible, remains eternally subservient and unchangeably linked to the eternal mind. True science is bastardized by intimating that the life in matter can be destroyed by any intensity of thermal negation (frigidity). Can finite man make use of an infinite element to neutralize infinity? Thermal negation causes molecular oscillation to diminish, or even seem to cease, but the results brought about from this superficial appearance of matter coming to rest are that the latent energy existing in the molecular zone is transferred to the inter-molecular, increasing the oscillations of the inter-molecular in the same ratio that the molecular is diminished. All the art that man can employ to induce the same effect on the

inter-molecular zone ends here. Granting, however, that it were possible, what would ensue?

"A disintegration, of the most intense explosive character, of the volume experimented upon, destroying the apparatus and its surroundings. But no artifice of the physicist could ever produce such conditions. In the disintegration of water by vibratory changes of atmospheric base (a triple order of sympathetic vibration, molecular, inter-molecular, and atomic simultaneously projected) the inter-molecular depths only are interfered with, the result being that latent energy is liberated, showing a pressure of 2,000 atmospheres, when barometric conditions are favorable.

"The physical organism (through the medium of celestial radiation) is a trinity, both in regard to its visible form and the invisible sympathetic streams which govern it, in its individual and combined movements. The visible includes the molecular, the atomic and inter-atomic in combination; while the invisible, or spiritual, includes the etheric, inter-etheric and luminous in combination, each of which is essential to the proper completion of the combined action, comprising as it does every minute law governing the celestial and terrestrial universe.

"Life begets life; the celestial life begets the terrestrial life; the God-life begets the man-life. *Celestial radiation is the pure soul of all matter*, both earthy and gaseous. Thus we are linked in all our environments to the divine, our cerebral aggregations being the highest medium whereby celestial sympathetic reflection associates with our organisms, and is our only source of knowledge of ourselves. We have, with our mental and physical forces, a duality of action which, when combined with the celestial, makes up the triplet or trinity. With the mental, the superficial visible, or outward sight; with the inward, or spiritual invisible, we have the spiritual link connecting mind and matter, the order of transfer being:

"*First.*—Celestial radiation, or etheric.

"*Second.*—Mental impregnation, or inter-atomic.

"*Third.*—Physical movements, or inter-molecular.

"Or again:

"*Ninths.*—Sympathetic transfer from the celestial luminous.

"*Sixths.*—Sympathetic impregnation of matter.

"*Thirds.*—Physical movements."

Thus the following question is answered, asked by Oliver Lodge (even though, with the professor's knowledge, the answer seems to be but "arrant gibberish" to him):

"By what means is force exerted, and what definitely is force? Here is something not provided for in the orthodox scheme of physics. Modern physics is not complete, and a line of possible advance lies in this direction."

Vibratory physics has here reached the boundary line dividing the infinite from the finite, the link between mind and matter. Here we must pause; but it has taught us that it is only in the supreme conditions of celestial reflection or sympathetic transfer that we live, move, and have our being; through which every thought, or flow of the mental, actuates the physical organism, on the same order that an illuminated centre radiates and lights up its surroundings.

Mr. J. Townshend, in his paper "The Planet Venus," read at Leeds, in April, asks:

"Are hydrogen, nitrogen, hellium, etc., really elemental substances, or are they evolved from ether? If so, what is ether? Whence the impulse which operates upon it, and what is its nature? Thus we turn from effect to cause in search of some first principle upon which the mind can rest. But ere this the light of science has failed us, for who by (scientific) searching can find out God?"

Sympathetic vibratory or spiritual physics answers these questions, and, as has been said, promises to burst upon the searchers after truth as the one mighty and complete revelation of some of the mysteries of creation.

> "Science was faith once; faith were science now
> Would she but lay her bow and arrow by
> And arm her with the weapons of her time."

"And God breathed into man the breath of life," celestial radiation, "and man became a living soul."

The cause of the effect, the source or fountain-head of all matter, is the celestial Mind—Deity, from whom all power emanates, and whose laws of sympathetic association reign over and control all matter and all substance. Spirit is substance, as Spinoza taught: "The universe is one. There is no supernatural; all is related, cause and sequence."

"Like fire, which is a spiritual order of vibration, spirit is latent in all matter. One might as well try to operate a steam-engine without its boiler as to give motion to matter against the conditions imposed by nature, or to propose a new method of controlling the action of our physical organisms (other than through the sympathetic transfer of our mental forces) as an improvement on the one instituted by the Almighty.

"Although there is as much difference in the molecular construction of spirit and matter as there is between hydrogen and forged steel, yet the flow of spiritual radiation, from the fountain-head of force, operates under the one unvarying law with both; for "nature never changes her processes," and she cannot be forced into any position which is antagonistic to her sympathetic law of action; such, for instance, as it would be were a gas to be solidified. The disintegration of water by heat is only a low order of crude molecular dissociation, visible in its production of steam; but the dissociation of hydrogen and oxygen cannot be made visible. Physicists are misled by visible effects. Nature, by her process of sympathetic vibration (an order approaching the luminiferous) could take up the atmosphere that encircles our globe, and yet solid matter would not even then be produced. By another order of progressive sympathetic vibration, associated with the high luminous, the molecular condition of the atmosphere so taken up would not represent a cherry-stone in volume."

Nothing exists but substance and its modes of motion, says Spinoza; thus teaching that spirit is substance. "Soul is the body or organ of the mind, and as such they are inseparable forever. Mind and soul are one, soul and body are two. Soul can never be without mind, body can. As in the

mortal life, so in the immortal life, mind cannot be or act without a body." Sympathetic physics teaches that the luminiferous ether, a compound inter-etheric element, celestial mind force, is the substance of which everything visible is composed, and that this great sympathetic protoplastic element is life itself.

"Consequently, our physical organisms are composed of this element; the focalizing or controlling media to the physical having its seat in the cerebral convolutions from which sympathetic radiation emanates. This sympathetic outreach is mind-flow proper, or will-force; sympathetic polarization to produce action, sympathetic depolarization to neutralize it. Polar and depolar differentiation resulting in motion. This element sympathetically permeates all forms and conditions of matter, having for its attendants gravity, electricity, and magnetism, the triple conditions borne in itself. From this '*soul of matter*' all forms of motion receive their introductory impulses. The physicists of the present age ignore the sympathetic conditions that are associated with the governing force of the cerebral and the muscular organism. The evolution of a volition, the infinite exciter, arouses the latent energy of the physical organism to do its work; differential orders of brain-force acting against each other under dual conditions. If there were no latent energy, to arouse sympathetically, there would be no action in the physical frame, as all force is will-force.

"Enough alternate active energy could be evolved, in a cubic inch of steel, by the proper sympathetic exciter, to do the work of a horse, by its sympathetic association with the polar force in alternate polarization and depolarization. This is the power that I am now getting under control to do commercial work. In other words, I am making a sympathetic harness for the polar terrestrial force." KEELY, 1892.

In 1893, Keely, in reply to the question, "What do you include in the polar forces?" answered, "Magnetism, electricity, and gravital sympathy; each stream of force composed of three currents which make up the governing conditions of the controlling medium of the universe. The

ninths which I am now endeavoring to graduate to a sympathetic mechanical combination will, if I succeed, close my researches in sympathetic physics, and complete my system." Within the year the announcement was made that Keely had completed this graduation, with entire mechanical success, "hooking his machinery on to the machinery of nature." In thus having realized the ambition of his life, he takes no credit to himself, saying that physicists would long since have discovered all that he has discovered if they had been in possession of the proper researching instruments, and that the theories they have advanced show that they are misled by the imperfections of their instruments. He has always maintained that "it is only when science holds the reins of the polar negative harness that commercial success will follow, and not one hour before." But science, to whom the reins were offered in 1884, refused to take them, fortunately, for mechanical physics could have rendered Keely no assistance in unraveling the mysteries of sympathetic physics.

Buckle, in his address, "The Influence of Women on the Progress of Knowledge," discloses the foundation stone of sympathetic physics in these words: "The laws of nature have their sole seat, origin, and function, in the human mind. Not one single discovery has ever been made which has been connected with the laws of the mind that made it. Until this connection is ascertained, our knowledge has no sure basis."

As Dr. Gerard surmises, in his book on "Nervous Force," Keely is "a plagiarist in cerebral dynamics." The instrument that he calls the sympathetic transmitter is the brain of the propeller, and at last we have a discovery which gives a sure basis for knowledge; a discovery made by one who lays no claims to learning, for nature has taught him, in her works, all that he knows.

THE PROPELLER DESCRIBED.

The space which the propeller of the air-ship occupies in Keely's laboratory comes within a radius of six feet square. A small space for so powerful a medium—distributing over one thousand horse-power, as tested by experiment.

It consists of more than two thousand pieces, the principal parts of which are:

1. Positive graduating Chladna; guiding by polar action toward the north and reversing by depolar action.

2. Sympathetic polar negative transmitter; for operating and controlling the action of the machinery in producing polar and depolar power: liberating the latent sympathetic power in twenty-seven sensitized discs.

3. Polar and depolar intermittent accumulator, carrying eight focalizing discs for receiving and distributing the sympathetic polar negative flow. This device takes the energy sympathetically from the polar negative stream on the same order that a dynamo registers electricity from the earth to be distributed and redistributed: running the machine sympathetically.

4. Positive ring suspended on a small shaft with three points, the object of which is to preserve the integrity of the neutral (see Appendix) centre of the machine.

5. Two resonating drums: one positive, one negative, which multiply the intensity of the sympathetic flow.

6. Twenty-seven depolar triple groupings, nine in each grouping, consisting of three vitalized discs with resonators. These reply sympathetically to polar and depolar action.

7. Large polar ring. This ring is associated with the central resonators by nine resonating polar discs placed at equal distances. This is the medium for distributing the polar flow.

8. Small negative ring, which is the governor of the propeller, associated with a polar bar that oscillates from the polar field to the depolar field, somewhat on the order of a magnetic needle, governing the action of the machine to any given number of revolutions. The sympathetic rotation that exists in the resonating centre of this ring holds the neutral centre in subservience to celestial radiation, whereby a certain order of sympathetic disturbances gives the sympathetic radiation the requisite power to draw it to itself, accomplishing what is called atmospheric suspension on the same principle as that of sympathetic suspension.

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The condition of the mechanical requirements necessary to conduct successfully the line of research which Keely has been pursuing will be properly appreciated, now that he is able to demonstrate the simplicity and beauty of his system, under perfect control for commercial use.

Modern materialistic science is altogether unprepared for the revelation given in sympathetic vibratory physics; a revelation foreshadowed in this passage from the writings of de Maistre.

"Religion and science, in virtue of their natural affinity, will meet in the brain of some one man of genius, and the world will get what it needs and cries for—not a new religion, but the fuller revelation of revelation."

In the same prophetic spirit Oliver Lodge, in his paper on "The Interstellar Ether," writes:

"I feel as if it would be no merely material prospect that will be opening on our view, but some glimpse into a region of the universe which science has never yet entered, which has been sought from afar, and perhaps blindly apprehended by painter or poet, by philosopher or saint."

> "The ghost in man, the ghost that once was man,
> But cannot wholly free itself from man,
> Are calling to each other through a dawn
> Stranger than earth has ever seen: the veil
> Is rending, and the voices of the day
> Are heard across the voices of the dark."

APPENDIX.

Mr. Keely illustrates his idea of "*a neutral centre*" in this way: "We will imagine that, after an accumulation of a planet of any diameter—say, twenty thousand miles, more or less, for the size has nothing to do with the problem—there should be a displacement of all the material, with the exception of a crust five thousand miles thick, leaving an intervening void between this crust and a centre of the size of an ordinary billiard ball, it would then require a force as great to move this small central mass as it would to move

the shell of five thousand miles thickness. Moreover, this small central mass would carry the load of this crust forever, keeping it equidistant; and there could be no opposing power, however great, that could bring them together. The imagination staggers in contemplating the immense load which bears upon this point of centre where weight ceases. This is what we understand by a neutral centre."

In theorizing on the philosophy of planetary suspension, Mr. Keely says: "As regards planetary volume, we would ask in a scientific point of view, how can the immense difference of volume in the planets exist without disorganizing the harmonious action that has always characterized them? I can only answer this question properly by entering into a progressive synthesis, starting on the rotating etheric centres that were fixed by the Creator with their attractive or accumulative power. If you ask what power it is that gives to each etheric atom its inconceivable velocity of rotation, or introductory impulse, I must answer that no finite mind will ever be able to conceive what it is. The accumulation is the only proof that such a power has been given. The area, if we can so speak of such an atom, presents to the attractive or magnetic, the elective or propulsive, all the receptive force and all the antagonistic force that characterizes a planet of the largest magnitude; consequently, as the accumulation goes on, the perfect equation remains the same. When this minute centre has once been fixed. the power to rend it from its position would necessarily have to be as great as to displace the most immense planet that exists. When this atomic neutral centre is displaced, the planet must go with it. The neutral centre carries the full load of any accumulation from the start, and remains the same, balanced in the eternal space."

Again, Mr. Keely, in explanation of the working of his engine, says: "In the conception of any machine heretofore constructed, the medium for inducing a neutral centre has never been found. If it had, the difficulties of perpetual motion seekers would have ended, and this problem would have become an established and operating fact. It would only require an introductory impulse of a few pounds, on

such a device, to cause it to run for centuries. In the conception of my vibratory machine, I did not seek to attain perpetual motion; but a circuit is formed that actually has a neutral centre, which is in a condition to be vivified by the ether, and while under operation by said substance is really a machine that is virtually independent of the mass (or globe), and it is the wonderful velocity of the vibratory circuit which makes it so. Still, with all its perfection, it requires to be fed with the ether to make it an iudependent motor. . . ."

SCIENTIFIC CREATION.

By Julian Hawthorne.

Between human science and Divine revelation there has always existed hostility, more or less veiled. Science has been unwilling to admit the dogma of the miraculous in creation, and has striven to show that what purports to be miraculous is either lying tradition, or else is no miracle at all, but a strictly natural transaction, such as may be reproduced by science itself.

The inductive method of investigation has carried science so far that we may now, for the first time, forecast how far she may yet go. She has penetrated to the threshold of life itself, and would fain cross it. But the profoundest minds among her disciples begin to admit that they can go no further. The material world is theirs, or may conceivably become so; but the secret energy that maintains and shapes the visible appearance, the intelligent power that bridges gaps and supplies missing links—the God in the machine, in short—they have not reached or solved, and are no nearer doing so than at the outset; nor, indeed, in hope and expectation, so near.

The plane of matter, in other words, is the plane of effects, and that of mind or spirit is the plane of causes; and between them the difference is discrete in degree. Instead

of being continuous, as in a spiral, they are in a series, as thought and speech, will and act, love and heat. Hence, though spirit continually informs and moulds matter, matter can never generate from itself the birth of spirit. Matter is dead—philosophically it *is* not; it only appears to be—that is, it exists, goes forth from Being, in answer to the spirit's impulse to expound itself in the arena of mortal sense.

It is only after man recognizes his limitations that we attain the sphere of our greatest usefulness. Having acknowledged the existence and supremacy of spirit, we are now in a position to produce effects on the material plane hitherto unattempted and even unimagined; for now we put ourselves under the guidance of spirit; as Emerson phrased it, we hitch our wagon to a star. By tuning ourselves to harmony with the simple but profound methods of what is termed "Nature," we avail ourselves of the true creative force.

The past age has seen the glorification of machinery. The extension of man's muscular power through engines has been carried to its extreme. Structures in which is embodied the maximum of energy with the maximum of economy whirl us about the globe, or heap up for us the product of agriculture and manufacture. The wheel, the lever, the wedge, steam and electricity, have done mighty things for man; and it seems strange, in contemplating his wealth and luxury, that poverty, misery, crime, and disease are, if anything, more burdensome and minatory than they were before all this increase of opulence and mastery began.

But, in truth, the bulk and brute force of our machinery form the barrier between us and true efficiency. A higher mechanical intelligence will perceive that the existing resources of nature are our real machinery, which have been all this while awaiting our discovery of the right means of using them. The slighter the medium between us and them, the greater will be the success of the application. And the law which leads us to this application has the name of the Law of Vibration.

It may now be affirmed that vibration lies at the base of all material phenomena. The universal ether is the real

protoplasm; from its vibrations result the various substances which constitute the realm of physical nature. An impulse of the spirit, communicated to the cells of the brain, produces the vibration known as thought. By the atmospheric vibrations of speech, thought is conveyed from one mind to others. The different gases are special forms of etheric vibration; the frozen gases we know as solids are characteristic modifications of the same vibrations. Atoms might be described as the nuclei or meeting-points of concurrent vibrations. Thus, in the last analysis, "matter" disappears in a mode of motion, the cause of which is spirit.

Broadly speaking, then, the man who can control at will the diverse orders of vibration can mould the universe at his pleasure. Out of the apparent void of the invisible and impalpable ether, he can call forth palpable substance. On the other hand, he can restore substances to their primitive etheric condition. And the sole magician's wand needed to perform these vital feats is the mastery of the law of vibration.

All this is easily said; but who shall fashion for us this wand of physical omnipotence?

Among the many warring voices of contemporary life, there is one, speaking in a deep undertone, which utters a conviction interior to all doubts and denunciations. It expresses the faith that the world is upon the verge of a new departure in the modes and conditions of life. A higher state of existence, both on the material and the spiritual plane, is promised us; in this expectation the man of science and the man of religion are agreed; and the impartial onlooker, could such be found, might reasonably surmise that Providence designs the union of the two orders of development in an indissoluble marriage. The power which the control of matter would bestow upon man is greater than he could safely have been entrusted with at any period of his past career. It is a power which could be used by the evil as by the good; therefore, if the world be indeed governed by divine wisdom and goodness, we may expect it to be placed in our hands only after the accomplishment of a regenerative work wrought in our spiritual nature. The word

of Scripture must be vindicated, "The seed of the righteous shall inherit the earth." Not until man has ascended to the throne of his own soul, abdicating his personal life that he may enjoy the boundless freedom of life for others, can he be held worthy of holding the sceptre of the material world. Only when he stands ready to administer the earth in the interests of his fellow, will he find the key of its infinite treasure-house.

To a superficial view, the moral and religious horizon has seldom appeared darker than at present. Church and State both seem impending to their fall. But even greater was the cloud of spiritual darkness upon the earth at the moment preceding the birth of Christ; and throughout human history, the powers of Hell have always seemed most energetic and successful just previous to their overthrow before the rising of some new star of hope. In truth, the tumultuous activity of evil influences is caused by the inner stirrings of the Divine Spirit, advancing to a fresh incarnation. When Satan's empire is assured, it rests in comparative tranquillity; only when its overthrow is at hand does it manifest the agitation and uproar which are misinterpreted as evidence of augmenting authority. It is because the seeds of spiritual revolution and regeneration are even now sown, that anarchy and infidelity appear to threaten the annihilation of human society.

With this premise as to the spiritual outlook, let us now turn to the field of science.

Here the signs of advance are far more unequivocal. In all departments there is a similar stirring toward the light. Physicists are solving secrets hitherto deemed impenetrable, and mechanism is steadily tending toward an unexampled simplicity and efficiency of means and processes. The epoch seems at hand when no man shall want for abundant means of subsistence, and when, therefore, we shall be free to turn our activities to the cultivation of goodness and beauty. The world is to be transformed into a paradise of loveliness and peace, in which men and women of angelic stature shall live lives of harmony and holiness.

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Already such names as those of Clerk Maxwell, Lord Kelvin, Oliver Lodge, Edison, Tesla, and many another, are quoted as heralds of the new scientific dispensation. And the more closely we study the work of these men, the more clearly does it appear that all alike are verging toward a single conclusion or achievement—the analysis and mastery of that philosophical abstraction that has so long defied all attacks to comprehend and harness it. Approaching the problem from many different directions, their eyes are all fixed upon the same goal, and the energies of each are strained to be the first to attain it. Possibly each, upon his own chosen course, may be victorious, and the revelations of one shall supplement and fortify those of another.

Among these leaders of thought and investigation there is one whose name is heard less often than the others, and seldom with reverence or faith; yet there are those who believe that John Ernst Worrell Keely, the Philadelphia experimentalist, is conducting his researches upon a higher and more advanced plane, and with promise of larger success, than any of the others. In common report, he is held to be little better than a charlatan and a humbug; and his "motor" is uniformly referred to with a smile of skepticism. This incredulity regarding Keely must have a cause, and it is not far to seek. For twenty years or more he has been before the public; from time to time, during that period, he has allowed rumors to transpire of great things which he was on the point of accomplishing, and, upon the strength of these rumors or assurances, money has been subscribed and a company organized. And yet, from first to last, Keely has always disappointed popular expectation; no practical machine, no generally comprehensible result, has ever come out of his workshop. At this day, so far as the world knows, he is as far from the solution of his enigmas as at the first moment that he turned his attention upon them.

Nor is this all. In response to more or less pressure from without, Keely has occasionally endeavored to give an account of himself, with the result of darkening counsel to such a degree that even his nearest allies are powerless to enlighten

it. The terms of the language in which he purports to explain himself are unintelligible; his utterances read like gibberish, and it is not surprising that most people reach the conclusion that the man is only seeking to disguise, beneath an inky discharge of incomprehensibilities, the dismal fact of his own ignorance and emptiness. Finally, it is not denied that his early education was not what it might have been, and such scientific training as he has received has been administered by himself in the course of his experiments.

Here are reasons enough, in all conscience, for maintaining a skeptical or agnostic attitude toward Mr. Keely, and he has not improved matters by the fact that he has deliberately antagonized some persons who might have been of service to him.

So much in opposition to Keely may be conceded. But this does not exhaust the subject. There are considerations to be urged on the other side, and it is but fair to give them audience.

To begin with, no one who has investigated him will deny that he is a man of genius, and that his foibles are such as geniuses are wont to manifest. Secondly, it is indubitable that he believes in himself; whether the belief be insane or otherwise, he possesses it. The work which he took up nearly a generation ago he is still pursuing with undiminished zeal and confidence, and the indiscretions of which he has been guilty are not such as would be committed by a sharper or a fraud.

Again, the failure of his attempts to explain himself may be regarded as his misfortune, quite as reasonably as his fault. It is not easy for a man untrained in scientific phraseology to state scientific facts lucidly and logically; and in Keely's case there is the obvious additional difficulty that, by the premises of the case, he is dealing with unprecedented matters, which, to some extent, demand the invention of a language for their conveyance. It may or may not be possible hereafter to translate Keelyese into every-day scientific phraseology; but meanwhile we are scarcely justified in condemn-

ing what the man has done on the evidence merely of what he has been able, or has chosen, to say.

The insinuation that Keely is keeping up an imposture, with the object merely of supporting himself on the eleemosynary donations of his dupes, is hardly a plausible one. A man of his ability could support himself much better by turning to other occupations. A man does not shut himself up in a dingy office week in and week out, from dawn till dusk and after, during upward of twenty years, for the sake of avoiding working for a living. He is doing something that interests him and absorbs all his energies, and in the final accomplishment of which he has never lost faith. In the pursuit of this object he has made many mistakes, and has lost a great deal of time in following out *cul-de-sacs* or impassable paths. He began with a very partial and inadequate idea of what was before him—of what the phenomena which he thought he perceived meant and led up to. His work has grown with him, and he has grown with his work. His supporters have been deceived; but it has been with a deception that misled himself no less than them. When he saw his errors, he declared them frankly; they lost patience with him, but he never lost patience with himself—with the idea which he was on the trail of. He was like Thor, the Thunder-god, who, thinking to drain the cup of the giants of Jotunheim, found out ere long that its bottom was filled from the ocean. Once he thought he would be satisfied with a terrestrial motor; now he sees himself at grips with the vitals of the universe.

The above suggestions aim to show that Keely has claims to be regarded as at least an honest man, whether or not a self-deceived one, and his own worst enemy. But, after all, the point that we are chiefly interested in is whether he has actually done anything that is new and likely to prove valuable to the world; because, if he has not, we may be content to leave him to his own devices, which can have no further practical concern for us.

At this point, I am tempted to introduce my own experience of Mr. Keely; but I am restrained by the reflection that I

can lay no claim to exact scientific knowledge; and in a matter of this kind, where the thing examined pretends to be wholly novel and unprecedented, it is plain that exact knowledge is precisely what is indispensable. At the time of my visit to the scene of the much-debated phenomena, however, I found myself in company with two or three men of acknowledged scientific attainments, who candidly confessed themselves as little competent as I was to devise an explanation of what Mr. Keely showed us. Movements took place which there were no visible or hitherto recognized means of accounting for. A heavy metallic sphere revolved at great speed; an isolated compass-needle did the same; weights immersed in a tall glass jar filled with water rose upward and sank again, or rested midway. And all that Mr. Keely did was to tinker with a stringed musical machine, fitted with singular appliances, and to blow upon a small mouth-organ at intervals. The assumption appeared to be that musical notes produced vibrations which affected the "chords of mass" of the things operated on, and the "polar currents" were in some manner induced to participate in the strange results. I know nothing about that; what I know is, that the things which took place were not caused, so far as I or the scientific gentlemen present could detect, by either steam, electricity, or compressed air. Meanwhile, Mr. Keely asserted that the efficient cause was a discovery of his own; and so far as I was concerned, he might as well have stopped there, inasmuch as I was able neither to contradict him, nor to comprehend a word of the alleged explanations wherewith he favored the company.

On the other hand, the man himself was open to my inspection, and I am bound to admit that he impressed me as being a personage of secretive and eccentric character, but withal honest in his professions, and an uncompromising fanatic in his pursuits. There was an expression of gloomy triumph and challenge in his swarthy and rugged countenance, as he wheeled round in his chair and faced us, when he had accomplished the achievement promised us; and I fancied he was not insensible to an emotion of enjoyment of our

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undisguised perplexity over what was happening. "Which of you convinceth me of humbug?" he seemed to ask. Keely is not a man to be easily fathomed or read; he is involved and dark in speech; but there was nothing in his dingy and shabby little room which was not freely open to our examination and question, and he had the air of one who had steeled himself against incredulity in his examiners, but who felt nevertheless the deepest inward conviction that he was right, and that it was a question of time only when this should be triumphantly vindicated before all the world. But I think he rather likes to mystify people, and is by no means averse from snubbing those who come to him with intent to "expose" him. If I am right, he certainly cannot be accused of observing the conciliating policy which would be the only sensible one for him under his present circumstances.

But when I picture to myself a man in the tremendous situation which Keely professes to occupy—that of holding in his hands, and being on the brink of reducing to practical conditions, a power that can be measured only by the energy of the planet itself, illimitable and inexhaustible; when I see him toiling for half a lifetime at his gigantic theme, facing all manner of disbelief and scoffing, unable to reply adequately or to express himself in available language, I am free to admit that I cannot ask such a man to conform to ordinary conditions of conduct or manner, or to appear in any respect orthodox, commonplace, and ingratiating. His attitude and office are unique, and it is not for us to set down the pegs that make his music. And such a man as this, so nearly as I could judge, Keely did seem to me to be.

It is some years since I saw him, but he has been recalled to my special thought by the appearance of a book called "Keely and His Discoveries," written by the brave woman who has stood by him and believed in him when he would otherwise have been left nearly or quite without a friend. She has helped him morally and substantially, and her book is, among other things, an assurance that she sees more cause to have faith in him now than ever before. She writes with the generous enthusiasm of her sex; but she knows more

about the subject than any one else, except Keely himself, and her statements, illustrations, and arguments are worthy of serious consideration. The matter is second in importance to no other; and if, as seems to me more than probable, Mrs. Bloomfield Moore is justified in her belief, then it shall fare well with those who are not afraid, at this stage of the game, to investigate dispassionately and diligently the grounds upon which her faith is based.

THE PROBLEM OF THE POLE.

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Sir John Barrow said, half a century ago: "The North Pole is the only thing in the world about which we know nothing; and that want of knowledge ought to operate as a spur to adopt the means of wiping away that stain of ignorance from this enlightened age."

This remark needs to be read with some mental reservation. We know nothing of the South Pole either. And at that time we knew next to nothing about the interior of Africa, and very little about the central regions of Asia. The stain of ignorance in regard to these two continents has been wiped away. Asia has not only been explored, but taken possession of. The Dark Continent has lost most of its darkness, and just now the nations of Europe are disputing, not as to who shall explore it, but as to who shall own it. The African apple has been cut up into large slices and divided among those hungry nations—who possess it largely on the map, and to some small extent in fact.

To-day the polar regions of the earth form the great remaining geographical problems. That of the South Pole may be an unsolvable one. It lies locked in such mighty fetters of ice that we can scarcely hope to break them. The North Pole, on the contrary, holds out a faint promise of

attainment which has kept men knocking at its portals for centuries, and step by step forcing their way inward. Yet the effort has been a long and baffling one. Discovery in America began in this region, when, shortly before 1000 A. D., the bold Norseman, Eric the Red, sailed to Greenland and colonized its western coast. Columbus had not long made his discovery in the south before new voyages began to the northern seas. Cabot reached Labrador in 1497, and three years afterward Cortereal attained the latitude of 60°. In 1553 Sir Hugh Willoughby made the first effort to find a northeast passage from the Atlantic to the Pacific, and came within sight of Nova Zembla, but perished with his men on the coast of Lapland. Other Englishmen made efforts to explore this northeast passage, among them Henry Hudson, the discoverer of Manhattan Island, but none of them got much beyond the point reached by Willoughby. It was reserved for Nordenskiöld, a voyager of our own day, to complete this difficult journey, and to sail into the Pacific after traversing the seas north of Europe and Asia. This was in 1879, three and a quarter centuries after Willoughby's disastrous effort. In 1889 Captain Wiggins succeeded in utilizing the knowledge gained by Nordenskiöld, and made a trading voyage to the Yenissei River of Siberia, opening a new track to commerce which bears promise of future importance.

The northwest passage proved as attractive to navigators as the northeast. The early English voyagers were filled with the idea that a short and easy way might be found through the American Continent from ocean to ocean. The first voyagers up James River had this hope in mind. Henry Hudson was moved with the same fancy in his exploration of the Hudson River. Finding that the continent could not be tapped in its centre, voyagers began to seek for a northwest passage around America, Sir Martin Frobisher being the first, in 1576. In 1585–88 Davis sailed north, up the strait bearing his name, to 72° 41′, along the west coast of Greenland. Others followed, among them Henry Hudson, who had made former efforts to reach the Pacific, and who

now discovered the great strait and bay which bear his name, and perished, through the treachery of his sailors, in what he supposed was part of the great ocean he sought. Various later voyages were made with the same end in view, the best known among them being that of Sir John Franklin, which left England in 1845, with the hope of tracing a passage from Lancaster Sound to Bering Strait. Its fatal ending, and the many expeditions of search to which it gave rise, have made this voyage famous in the annals of Arctic research. One of these accomplished the long-sought-for discovery of the northwest passage. Captain McClure entered the Arctic Ocean from Bering Sea in 1850. His ship was frozen in the ice, but he and his crew were rescued the next spring by Sir Edward Belcher, who had sailed in from the Atlantic. He returned to the Atlantic with the rescued men, so that McClure and his sailors actually traversed that long-sought northwest route between the Atlantic and the Pacific, though under difficulties which do not invite a repetition of the voyage. He was knighted for his exploit, and Parliament voted to him and his crew the sum of £10,000.

While this search for passages east and west went on, many bold voyagers were seeking the Pole, and encountering a vast amount of hardship and meeting with repeated failures in their effort. It is not proposed here to name these various expeditions. It will suffice to say that through them much has been done in mapping out the polar seas between the Arctic circle and the eightieth degree of north latitude, and to some extent beyond that parallel. As regards approach to the Pole, however, the progress has been slow and baffling. In 1827 Captain Parry reached the high latitude of 82° 40′ north. This was not surpassed until 1876, when Captain Markham reached, by means of sledges, the latitude of 83° 20′, and 1882, when Lieutenant Lockwood, by the same means, reached 83° 24′, the most northerly point yet attained, yet not more than about fifty miles north of that gained by Parry more than half a century before.

During recent years the expeditions have been numerous, and to some extent disastrous. The majority of them pur-

sued the West Greenland route, including those of Kane, in 1853–55; Hayes, in 1860–61; Hall, in 1871; Nares, in 1876—in which Markham reached the high latitude named; and Greeley, in 1881–84—in which Lockwood sledged to the highest point north so far reached. In 1869–70 Captain Koldewey sailed up the east coast of Greenland to Cape Bismarck, 77° 1′, the highest point reached on that coast. In the seas of the Eastern continent Parry—in 1827—was followed by Nordenskiöld, who continued to explore the seas about Spitzbergen from 1858 to 1872, and in 1878 traversed the whole extent of ocean between Norway and Bering Strait. Somewhat earlier an Austrian expedition, under Lieutenants Payer and Weyprecht, had penetrated far to the north, discovering a new island about two hundred miles north of Nova Zembla, as large, to all appearance, as Spitzbergen, and extending from 80° to or beyond 83°. In 1880 and later this land was still further explored by Mr. Leigh Smith. Of other explorations of this region we shall here speak only of the unfortunate *Jeannette* expedition of 1879–82, in which the vessel was crushed by the ice, and its gallant commander and many of his men lost on the inhospitable Siberian coast.

As regards the results of the expeditions so far named, they have been small if compared with the great suffering and considerable loss of life attending them. They include the important discovery of the location of the magnetic pole, the considerable advantage to the whale fishery from the exploration of the Arctic seas, and a large and important addition to geographical science in the tracing of the boundaries of Greenland and the discovery of numerous smaller islands in the ocean of the north. To these matters of interest and importance must be added valuable observations in the sciences of meteorology, biology, geology, etc., the study of ocean currents, of the movements and conditions of the ice pack, the formation and progress of glaciers and icebergs, with various other results of more or less importance.

Certainly there has been little of worth, if measured by the ordinary standard of value, its price in cold cash. But

there are other standards of value. There are men who value knowledge above money, and there are those of such ambition for distinction, of such thirst for discovery, and of such energy and enterprise, that the search process is sure to go on while there remains any large area of the earth's surface unexplored, however much the seemingly misdirected efforts of the explorers may be deprecated, or by whatever hard names the stay-at-homes may designate these daring pioneers. This much may justly be said; the voyagers of the northern seas are on the high road to fame, and among those who most deprecate their efforts are many who await with the deepest interest their results.

What has been so far said is preliminary. Exploration in recent years has taken new methods and is pursuing new paths, and it is of these we wish particularly to speak. For centuries the explorers of the northern seas have kept to a fixed plan, that of trying to force their way in ships mile by mile through the vast fields of ice, enduring the severest hardships and perils in their vigorous struggle to add a few miles more to the record of progress north. This method has probably done all that it is capable of doing. It has been supplemented by sledging over the ice, by which, in the cases of Parry, Markham, and Lockwood, the greatest northing was attained. Much of the value of the work done consists in its suggestion of new and better methods, which seem far more promising of ultimate success. During the present year four expeditions are out, pursuing new lines of exploration, with at least the hopeful promise that they will add something of value to our knowledge of the polar region, if, indeed, some one of them does not solve the mystery of the Pole itself. These are the expeditions of Peary, Nansen, Jackson, and Wellman, which we propose more fully to describe. Before proceeding, however, it is of interest to say at this point, that the Davis Strait and Baffin's Bay route has become so well known, and its dangers and difficulties so thoroughly understood, that it is proposed to convert it into a summer tourist route. Dr. Frederick A. Cook, who has in view an expedition to the Antarctic seas,

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with the design of learning what can be accomplished by sledging in that little-explored region, has undertaken, with the purpose of raising funds for his proposed expedition, to conduct a tourist voyage to the north as far as Smith Sound. It is by no means improbable that, before the opening of the twentieth century, a run to and beyond Baffin's Bay may be a favorite summer excursion, as an easy means of escaping the mid-summer heats.

As regards the Peary expedition, it was suggested by certain facts of interest discovered in the exploration of the interior of Greenland by Nordenskiöld in 1883, by Peary himself in 1886, and by Nansen in 1888. The first two entered at points well up the west coast, and journeyed nearly a hundred miles inland. The last landed at a point on the west coast, and crossed the island to the east, reaching an interior altitude of eight thousand nine hundred and twenty-two feet. Those three adventures all yielded similar results. After a steep climb from the coast region an ice-bound altitude was reached, beyond which a largely level surface extended, the great interior of the island proving to be a broad plain of ice and snow, which offered a comparatively easy passage-way for dog-drawn sledges.

Lieutenant Robert E. Peary is a civil engineer in the United States Navy, a man of powerful build, vigorous constitution, and with a native love of adventure and exploration, in which he had more than once indulged. Arguing from the experience of Nansen in Southern Greenland, and of himself and Nordenskiöld at two points near the centre of the island, he concluded that similar conditions very probably existed in the north, and that it might prove a comparatively easy feat to reach the northern extremity of Greenland by means of a sledge journey over the interior snow plain, and perhaps attain with comparative ease as high a degree of latitude as others had reached in ships with unmeasured toil and trouble.

It need scarcely be said here that Peary was correct in his deductions. The details of his expedition are somewhat generally known, with the interesting result that in a single

year's excursion, and one much more pleasurable than painful, he gained a higher point north, and made more interesting discoveries, than many of his predecessors had done in years of hardship and disaster. Setting out in the summer of 1891, accompanied by his intrepid wife, Josephine Diebitsch Peary, he reached his selected winter-quarters on McCormick Bay, in Inglefield Gulf, where a comfortable dwelling was erected, with a sufficiency of fuel and provisions, and the Arctic winter was passed with little weariness and no serious trouble. Lieutenant Peary indeed had met with one mishap, the breaking of his leg; but this, through his wife's devoted nursing and his healthy constitution, healed before the winter had far advanced, and was as strong as ever again months before the season for the excursion north came round.

Lieut. Peary's journey began near the end of May, 1892. The first portion of it was up the steep ice-covered incline that bordered the interior, and which rose to a height of three thousand three hundred feet at a few miles inland, and to four thousand feet at about twelve miles from the coast. From this point the journey lay over a gradually rising plain of ice, covered deep with snow, over which the adventurers glided on long Norwegian snow shoes, or "ski," while dogs dragged their sledges of provisions and utensils.

With a single companion the intrepid explorer traversed for many days this elevated plain of dry snow, rising until it reached a level of eight thousand to nine thousand feet at a distance of eighty to one hundred miles inland, the interior features of the country being quite obliterated by its uniform covering of ice and snow. Whether the mountains, which surround the coast, extend inland, or the interior is a great basin filled to the summit level of the mountains with ice, could not be determined. All that was visible was that great white plain, its surface snow, its lower substance ice, over which day after day the adventurers pushed steadily northward, now through sunshine, now through clouds and fog—their journey over this monotonous expanse continuing for fifty-seven days. They unluckily

approached too close to the coast, lost ten or twelve days through entanglement in the rough ice and crevasses of a glacial region, and were forced to turn more and more to the eastward as they advanced, to avoid the heads of fiords that cut inward from the coast. Finally they were obliged to turn to the southeast, the coast evidently trending in that direction. At length, on the first of July, they found themselves unexpectedly at the termination of the ice cap of Greenland, while before them lay an expanse of red-brown rocks, with streams pouring over and through them from the melting snow, and cataracts plunging downward from the ice cap, while snow buntings flew about in numbers, making the air musical with their songs.

The easy gliding over the snow plain was at an end. Leaving their sledge at the edge of the rocks, and carrying a few days' provisions on their backs, the explorers set out with their dogs over the boulders of this new land. For four days they toiled onward, the ground being covered with sharp stones of all sizes, while occasional drifts of snow and rushing torrents impeded their progress. At length they emerged on the summit of a towering cliff, some three thousand five hundred feet high, and beheld before them a great bay, which, as it was now the Fourth of July, they named Independence Bay, while the point on which they stood was called Navy Cliff. The latitude was about 81° 37′. Looking north from their elevated position they saw beyond the fiord, which had stopped their journey north, another expanse of land, perhaps another island lying north of Greenland. To this they gave the name of Heilprin Land, in honor of Professor Angelo Heilprin, who had accompanied them in their journey north, as leader of the scientific expedition sent out by the Philadelphia Academy of Natural Sciences. Beyond a second fiord appeared another expanse of land, which was called Melville Land, in honor of a well-known Arctic hero.

Life was abundant in the land they had reached. Flowers were visible in the crevices of the rocks—yellow poppies and dandelions—birds and bees flitted or buzzed about, and in

the valley below them was a herd of musk-oxen, two of which they killed for food. After seven days spent in this northern land they started on their return journey, which they accomplished with ease and dispatch, pursuing a more southerly course, and reaching McCormick Bay on August 6.

Peary and his companion, Astrup, had traveled a distance of one thousand three hundred miles in ninety-six days, at an average speed of thirteen and one-half miles a day. In their return trip they made from twenty to twenty-five miles daily, and thirty miles on some days. Their dogs had been reduced in numbers during the journey, but five still drew their lightened sledge on their return. They found a relief expedition under Professor Heilprin awaiting them at headquarters, and returned in September to their starting point in Philadelphia, after an exceptionally fortunate experience.

Lieutenant Peary's expedition was doubly notable: First, in showing that Arctic exploration might be pursued with little hardship and as little danger; and second, in demonstrating the utility of his method of advance toward the Pole. The idea is a vital one, and promises to be fertile in future consequences. The first to pursue it has been Lieutenant Peary himself. Feeling that the excursion of 1892, though rich in results, was but preliminary and experimental, and eager to take advantage of the lessons then learned, he set out again in 1893, landing on August 3 at Bowdoin Bay, on Inglefield Gulf, which he proposed to make his point of departure on this occasion. Here a comfortable house was erected, and preparations made to pass the winter. Two women accompanied this expedition, Mrs. Peary and an attendant.

What the bold explorer proposes to do during the present summer is this: Starting about the middle of March of this year, he hopes to reach Independence Bay about May 1, and to make this the starting point for excursions in two different directions. As to hardship from cold during this journey he is not particularly concerned. His previous trip showed him the utility of reindeer and dog-skin clothing and fur-lined sleeping bags as a protection against the Arctic temperature, and also that in a short time a sleeping shelter could be

excavated in the compact snow, with walls of snow blocks as wind breaks. He has with him a number of Mexican donkeys, animals accustomed to carrying heavy loads in the low temperature and over the deep snows of the high Cordilleras, which he hopes to make very efficient aids to his dog-teams in the carriage of supplies. As an additional precaution he intended to establish, in the autumn of 1893, depots of provisions at several points on the route to Independence Bay, to be used on his return if necessary.

On reaching Independence Bay the explorer proposes to divide his party into two sections. One, composed of three men, is to journey southward, tracing the line of the east coast of Greenland, with the hope of reaching Cape Bismarck, four and a half degrees to the south, and thus completing the mapping of the east coast of the island. From Cape Bismarck they will travel directly westward to Bowdoin Bay, or to a more southerly point if necessary. Lieutenant Peary, with the other section of the party, proposes to journey northward along the strip of coast ice (since the absence of snow from the lands renders travel there too difficult), crossing the fiords observed in 1892, and exploring the land seen beyond, while sledging as far north as time and circumstances will permit. A journey of one hundred and twenty-five miles north will take him to the latitude reached by Lockwood, and he has strong hopes of at least passing this latitude, if not of reaching a considerably higher northern point. It is his purpose, however, unless hindered by unforeseen difficulties, or induced to delay from other considerations, to return in time to reach Bowdoin Bay in late August. During the four months between May 1 and the end of August, much of interest and importance may be accomplished.

A relief expedition under the command of Henry G. Bryant, known for his recent exploration of the Great Falls of Labrador, is already on its way north for the purpose of bringing back the exploring party. It is even proposed to bring back intact the house in which they have passed the winter. A secondary purpose of the party on the relief ship *Falcon* is a visit to Ellesmere Land, with the hope of rescuing

or discovering traces of the young Swedish naturalists, Bjorling and Kallstenius, who were wrecked there in 1892.

The hoped-for return of the Peary expedition in the autumn of 1894 will probably be paralleled by that of an expedition of quite another kind, whose "dash for the Pole" it is hoped to accomplish in a single summer. This expedition next calls for description. It seeks to repeat, with improved resources and greater knowledge of the conditions, the exploit of Captain Parry, who, as early as 1827, reached by sledging across the ice-field nearly the highest latitude yet attained.

Walter Wellman, a young, energetic, and enthusiastic journalist of Washington, D. C., is the leader of this expedition, which set out on May 1, 1894, from Tromsoe, Norway, for Spitzbergen, which is to form its true point of departure. On Dane's Island, off the northwest coast of Spitzbergen, stands an old house built by seal hunters. In this it is proposed to leave a year's supply of provisions, with two men to guard them, as a precaution in case it should become necessary to winter on that island. Mr. Wellman's hope for success lies largely in the character of his boats, which are made of the light metal aluminium, each being only four hundred pounds in weight, while they are so constructed that they can readily be lifted from the water to the ice, placed upon runners of the same metal, and converted from boats to sledges. For the drawing of the latter he depends on Belgian draught dogs, a number of which hardy animals he has taken with him. The boats are provided with water-tight lockers for the storage of provisions.

There are two difficulties to be overcome, as indicated by Parry's experience. One of these is the wide expanse of broken and hummocky ice, caused by the impingement of the drift ice upon the land, which must be crossed before the smooth field beyond can be reached. The second is the southerly drift of the ice pack, which baffled Parry by carrying his sledges to the south almost as fast as they could be drawn to the north. Mr. Wellman hopes to avoid this trouble by an early start, trusting to get far north before the drift begins. His chances of surpassing Parry seem excellent.

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Possibly he may gain a much higher latitude. He proposes to be home again in November, and will do so unless the Arctic sea gods dispose differently.

To these two expeditions, markedly different in character, must be added a third, equally distinct and still more novel. This is that undertaken by Fridtjof Nansen, already named as having crossed Greenland, and who now proposes to drift through the polar seas, and return with the story of their mysteries. His enterprise is based on certain interesting evidences that a current sets across the polar area from North Siberia to West Greenland, by whose aid he hopes to be drifted through these unknown seas, and possibly over the locality of the Pole itself. These evidences are the following: On June 18, 1884, three years after the crushing of the ill-fated *Jeannette* in the ice near the New Siberian Islands, there were found on the ice at Julianehaab, in Southwest Greenland, relics from that vessel, consisting of the trousers of one of the sailors and parts of the ship's papers. Drift-wood is also annually thrown on the coast of Greenland, which can come only from Alaska or Siberia. Admiral Inglefield states that he has himself seen a large log on the West Greenland coast, which he thinks could have come from nowhere but Siberia, and must have taken the route which Nansen proposes to traverse. As for the time required, the relics from the *Jeannette* fix it as not more than three years.

These circumstances have proved sufficient to induce the daring Norwegian to undertake an enterprise of extraordinary risk and doubt. He has had constructed a vessel specially adapted to resist the crushing effect of the ice, and with such slope to the lines of its hull that it will probably be lifted by two meeting ice-fields and carried safely on their surface. This vessel, the *Fram* (or *Forward*), has been provisioned for five years, provided with boats in case the vessel should be crushed, and with a crew of thirteen men set sail from Christiania, Norway, at midnight of June 24, 1893, on what many deem the most foolhardy adventure ever undertaken by man. It was proposed to pass through the Kara Sea, and take

advantage of the current of relatively warm water pouring northward from the mouth of the Lena River, with the hope of being frozen in the ice after attaining a certain distance north, and floating with the moving ice-field over the polar area and southward to Greenland.

The last news of the *Fram* was of the date of August 6, 1893, when some Samoyeds saw her passing, between ice and land, along the Yarmal coast. Nansen intended to call, in September, at the mouth of the Olensk River, but failed to do so, and nothing more is known of him. He may have found it desirable to turn north off Cape Chelyuskin, and now either is far on his way north, or has met the fate of those who dare too boldly the Arctic ice; in which case the current to which he trusted may only bring us relics to tell the story of his fate.

There is still another expedition afloat and needing mention—that known as the Jackson-Harnesworth; the latter gentleman supplying the funds, Jackson taking the risk. This starts from England, and has a purpose in view resembling, and doubtless suggested by, that of Lieutenant Peary. Frederick G. Jackson, the leader of this expedition, proposes to sail, early in July, on the steam whaler *Windward* for Franz Joseph Land, and to explore this island, which extends from about latitude 80° to an unknown distance north, making his way by land or ice as far as chance and fortune will permit. For draught purposes, he has provided himself with a number of Russian ponies, and spent last winter in Northern Russia, experimenting with these hardy animals.

His general plans are the following: After spending the winter of 1894–5 at his selected headquarters on the island, he will, in the spring of 1895, move slowly northward, establishing a depot of supplies every thirty or forty miles, proceeding by way of Austria Sound and Petermann Land, the latter of which lies 83° north. Then, returning to his base, he will pass a second winter, and start north again in the spring of 1896, now taking advantage of the depots formed the year before, and traveling as rapidly as possible. He does not expect to return till 1897, and is likely to bring

back with him some highly interesting geographical knowledge.

There is one further project entertained, in a measure the outcome of those named, with a brief account of which this record of north polar exploration may close. This is that of Dr. Robert Stein, of the United States Geological Survey, who intended to set out the present year, but has been delayed. He proposes to establish a permanent station on Cape Tennyson, at the southeast point of Ellesmere Land, and to garrison it with fifteen men, always kept provisioned for two years. This point is frequently reached by whaling vessels, and can be easily kept supplied. Here Arctic recruits are to be trained, and from this point a fan of secondary stations is to be pushed out, with intervals between them of not over one hundred miles, which, as experience grows, will be increased to two hundred miles. Each of these stations will be garrisoned by five men, and will have a large area in which to obtain good supplies of Arctic game. Dr. Stein hopes thus, by an exploration possibly continuing for twenty years, to gain a wide knowledge of the polar seas and islands. A second base might hereafter be formed on Franz Joseph Land, and a third, perhaps, on Point Barrow.

Such is, briefly given, the present status of Arctic exploration. It will be perceived that the older methods have been widely departed from within the present decade, and new plans of operation adopted, which, in one instance at least, have met with notable success. Possibly the present year may yield us the story of still greater success, and it may prove that the true method of solving the riddle of the Polar Sphinx has been learned.

It does not seem proper to conclude this paper without some reference to another polar problem, that of the South Pole, long given up as insoluble, but which a daring explorer proposes again to undertake. Allusion has been made above to what may be denominated a "personally conducted Cook's tourist trip" to the neighborhood of the North Pole. The leader of this expedition, Dr. Frederick A. Cook, was a companion of Lieutenant Peary in his 1892 exploration, and the

success of that, with his experience gained in it, have inspired him with the idea that a near approach to the South Pole may, perhaps, be made in the same manner—by sledging over the inland ice. This idea he proposes to put to the test in 1895.

For half a century past, next to nothing has been done in the work of exploring the south polar area. The first voyage in this direction was that of the celebrated Captain Cook, in 1774, in which a latitude of 71° 15′ south was reached, and the Great Southern Continent of old maps disproved. In 1823 Captain Weddell pushed through the dense pack ice of that region to 74° 15′. But the period of most active south polar exploration was about 1840, at which time nearly all that is known of this region was learned. Of the several voyages made, the most valuable in results was that of Sir James Ross (1839–1843), who followed what appeared an ice-bound coast for a distance of five hundred miles. The land seemed high, and a lofty range of mountains was seen, containing the volcanic peaks Erebus and Terror, the former twelve thousand four hundred feet high. After strong efforts to make his way through the ice, he reached, on February 4, 1841, the high southern latitude of 78° 15′, the nearest approach to the South Pole that has yet been made.

The Wilkes exploring expedition of 1838–1842 sailed for a considerable length along the coast of what seemed to be an ice-bound continent, to which the name of Antarctic Continent has since been applied, though its actual existence is in doubt. After this period, exploration in that direction ceased, the more recent voyage of the *Challenger* only reaching the latitude of about 66° 30′ south. In truth, the seas in that direction, with their mountains of floating ice, were so forbidding, the land was buried under such vast masses of ice and snow, and the polar region was seemingly so surrounded and closed in with frozen lands and icy precipices, that the most daring adventurers gave up the idea of further exploration as impracticable, and men settled down to the belief that the region of the South Pole must remain forever shrouded in mystery.

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Dr. Cook—a worthy namesake of the first voyager of these seas—is of a different opinion. In his belief there is much still to learn, and he does not despair of even reaching the Pole. What else there may be to discover in that continent of ice only the effort can tell. He deems it not impossible that men may dwell there, improbable as it may seem. Valuable minerals and precious stones may, possibly, be discovered. Whatever there may be, there is certainly the unknown, and this has always a strong attraction for the human mind. Dr. Cook then, in short, proposes to winter on the Antarctic Continent—if continent it be—and to try what can be learned in a sledging journey to the south, after the pattern of Peary's journey to the north.

His plan of action is the following: He will take a steam whaler of about three hundred tons, the vessel to be provisioned for three years, and to leave New York about October 1, 1895. A supply of pemmican will be made from beef and tallow procured in South America, and the vessel will then steam southward to Graham's Land, reaching the point known as Louis Phillippe, where an ice-boat will be left, as a means of retreat should disaster be met further south. From that locality the steamer will advance south, pushing its way through the ice as far as possible. This may be much farther than has yet been attained. Steam-power has never been tried in these seas, except in the case of the *Challenger*, in 1874. Sir James Ross might have gained a higher latitude had he possessed steam-power. He saw many times an open sea ahead, which could not be entered for want of wind to fill his sails. As great a distance may be traversed by steam in a day as by sail-power in a week, and it is quite possible that a high southerly point may be attained by this new method of propulsion.

If, at the highest latitude reached, there exist land and safe anchorage, winter-quarters will be established there, a structure being built proof against the winds and so constructed as to form an adequate protection against the cold. In this the adventurers propose to spend the winter. Smaller buildings for scientific purposes will be erected, and observations in

meteorology, etc., will be steadily continued, while exploring parties will be sent out for preliminary work.

When the long polar night has passed, and a new day dawns on the far south, the most important work of the expedition will be adventured, a party of three or four selected men being sent on an overland journey to the south, with the aid of snow shoes, sledges, and Eskimo dogs. If possible, they will be preceded by a party which will establish an advance station several hundred miles to the south.

The sledging party is to proceed with all possible diligence, continuing until a certain time has elapsed, or two-thirds of its provisions are gone. A full set of scientific instruments is to be taken, and accurate observations made. Dr. Cook thinks it not at all improbable that a well equipped sledging party, starting from about 80° south, may reach the Pole, provided, of course, a smooth expanse of snow, such as Peary found in Greenland, exist. During the absence of this party, those left at headquarters will continue to explore and observe. The sledging party is expected to return about April 1, 1896, when the retreat to the north will begin.

As regards this projected expedition, all that can now be said is, that it is full of possibilities. Chance may favor it, or may be against it, and circumstances may render necessary a complete change of programme. However adverse chance may prove to be, something of interest is very likely to be learned. Dr. Cook is not at all troubled about the cold of the southern ice cap. He believes fully in the resisting effects of fur clothing, as tested by him in the north. He is having clothing made which will be a modification of the Eskimo dress, and will provide for himself an under-garment of bird skin, whose value he has learned. With such clothing he is confident that extreme cold can be endured. The winter-quarters will, of course, be heated with coal fires, as were those of Peary in the north.

All that can be said further concerning this proposed exploration is, that it is by no means lacking in promise, and if the conditions surrounding the South Pole should prove to be such as Dr. Cook hopes to find them, it is not impossible

that a higher latitude may be reached in the south than will up to that time have been attained in the north, even if his hope of reaching the Pole itself prove a fallacy.

THE CANALS OF COMMERCE.

By Prof. Lewis M. Haupt,

Consulting Engineer, the Trades League of Philadelphia.

The life of trade is limited by the facilities which exist for the interchange of commodities, while these facilities are in turn restricted by the physical obstructions to transit.

It is readily understood that transportation upon water is much cheaper than that over land, and hence it is possible to ship goods to much more distant points over the former than over the latter medium, at the same cost.

Although the continents are intersected by and enclosed within water-ways, yet their configuration is such that long detours are often required between the commercial termini, which frequently doubles the time in transit and reduces correspondingly the prospective revenue of the carrier, consignor, and consignee. As a stimulus to commerce, manufactures, agriculture, and allied industries, it is of great economic value to determine how to reduce the time required for a vessel to make her trip without too large an outlay of capital. The problem is most readily solved by reducing distances, where possible, by means of canals through the isthmuses connecting the countries to be circumnavigated.

The carrying trade of the world has grown so rapidly, and has attained such magnificent dimensions, as to have justified the outlay of hundreds of millions of dollars for the construction of existing ship canals like those of Suez, Corinth, Manchester, Sault Ste Marie, and others.

That canal best fulfills the requirements of commerce which saves the greatest percentage of distance in proportion to its length, and is at the same time so constructed as to permit vessels to navigate it in the least time. In this respect the

Nicaraguan route is pre-eminent, as, with but 26.8 miles of canal proper and 142.6 of river and lake navigation (total, 169.4), a distance of 10,000 miles around Cape Horn may be saved to the commerce of the world on each interoceanic trip.

The traffic through this canal should far exceed that through the Suez Canal, which is now over eight million tons; yet at the low estimate of only five million tons, at $2 per ton for freights and tolls, the revenue would be $10,000,000, or 10 per cent. on the estimated cost of $100,000,000. The engineer's estimate was, however, less than $70,000,000, which should be sufficient to cover all construction expenses. The experience of Suez would fully justify this undertaking, as being one of the best financial projects in the engineering world. The Suez Canal is one hundred miles long, cost about $1,000,000 per mile, and was built under great physical and financial difficulties, yet it is carrying a large traffic; its shares are held at over $500, par being $100, and they have paid 23 per cent. dividends.

Another canal, which may not have attracted much attention in the foreign market, but which is carrying the largest tonnage of any artificial channel in the world, is the link connecting the waters of Lake Superior with those of the Saint Mary's River. There is but one lift-lock built to overcome the twenty-two feet fall of the rapids of the "Sault," yet this lock has been enlarged several times, and a third and still larger lock is now under contract, while the depths of the water-way is being increased from sixteen to twenty feet. The tonnage last year approximated eleven million, while that passing through the Detroit River, which included the traffic of Lakes Michigan and Huron, was estimated to be nearly forty million tons. Most of this is transhipped at the lower lake terminals to the railroads, although a large portion of the grain passes to the Atlantic sea-board *via* the Erie Canal, which is but a shallow seven-feet water-way, carrying in some seasons as much as four million tons.

On the other side of the border, the Dominion Government is just about completing another large lock on its own territory, to surmount the "Soo" rapids into Lake Superior, and

it has expended over $54,000,000 in the enlargement of its canals connecting Lake Erie with the ocean, so as to secure a fourteen-feet channel through the picturesque valley of the St. Lawrence River. As this is double the draught now available *via* the Erie Canal, the commercial value of the Canadian water-way should be eight times that of its American competitor.

THE INTRA-COASTAL SYSTEM.

Probably nowhere in the world do there exist so great physical possibilities or so imperative commercial necessities for a deep-water canal as along the Atlantic sea-board of the United States. This coast-line, from Cape Cod to Florida Reefs, is a succession of sand-bars, dunes, and islands, inclosing large bays, sounds, and navigable streams, and having comparatively few inlets where deep-draught vessels may safely penetrate this *enciente* of sand, and find a safe refuge from storms. The great risks to maritime property are shown by the reports of the Life-Saving Service, which state that for the year ending June 30, 1893, the value of the vessels risked between Capes Cod and Hatteras was $2,825,765, while their cargoes aggregated $962,375, making a total of $3,788,140. The number of disasters during the year was two hundred and fourteen, and the value of the property destroyed was $1,146,395, while that saved was valued at $2,641,745—so that 29 per cent. of the property risked was lost. The greatest number of disasters (sixty-six) occurred that year in the Second District, which embraces the coast of Massachusetts, and the next largest number was on the coast of New Jersey, where there were forty-seven wrecks.

From New York Bay to the Delaware Capes, one hundred and seventy miles, there are no harbors of refuge, and even the Delaware Breakwater is no longer available for deep-draught vessels, while to the coasters it has proven very disastrous, for within a period of eighteen months no less than fifty vessels have been wrecked within its shelter.

This is but one of many good reasons for the immediate opening of a capacious interior water-way along this coast.

A more convincing and practical one, however, is the economy which would be effected by the great reduction in distance between our populous centres of industry. Thus the Cape Cod Canal, which is projected to connect the waters of Buzzard's Bay with Cape Cod Bay, at Sandwich, and is about nine miles long, will reduce the distance between Boston and New York from three hundred and ninety-eight to two hundred and fifty miles, a saving of one hundred and forty miles, or 35 per cent. The canal across New Jersey, from the Raritan Bay to the Delaware River, thirty-four miles long, would reduce the distance from two hundred and seventy-three to about ninety miles, effecting an economy of one hundred and eighty-three miles, or over 67 per cent.; while the enlargement of the present Chesapeake and Delaware Canal, with a ten-feet draught and a length of fourteen miles, would reduce the distance by water between Philadelphia and Baltimore from four hundred and thirty to one hundred and twelve miles, a saving of three hundred and eighteen miles, or 74 per cent.

Thus it will appear that by the reconstruction or enlargement of fifty-seven miles of canals, the present outside distances between these populous centres could be reduced from one thousand one hundred and one to four hundred and fifty-two miles, a saving of 60 per cent. This in itself would be an ample justification for the expenditure of a very large amount of capital to secure the result, but the physical conditions of the country which would be traversed by these canals is such that the actual cost of construction would be comparatively small. The estimated cost of the New Jersey link is $12,500,000, while the Delaware enlargement could be completed to tide level for $5,000,000, with the improved machinery now available.

As the tonnage now afloat on the waters from Long Island Sound to Chesapeake Bay amounts to over 70,000,000, of which a large percentage would be greatly benefited by the creation of these connecting links, there would seem to be no question as to their financial success; and the dense population, tributary to this highway of commerce, is a sufficient

guarantee to the statistician of an ample revenue from the existing and rapidly-increasing traffic of this canal.

Another great canal which is now under construction is the one connecting Lake Michigan with the Illinois River at La Salle, for the double purpose of providing an outlet through Chicago to the commerce of the Mississippi Valley, and for purifying the water supply. This water-way is to be one hundred and sixty feet wide at bottom and twenty-two feet deep, and is estimated to cost over $25,000,000.

Surveys have been completed also for a ship canal from the Ohio River near Beaver to Lake Erie, to provide a cheaper line of transportation for the ores and coal of western Pennsylvania, Ohio and vicinity, to the territory of the upper lake region.

Among the later canals of Europe, mention should be made of the North Sea and Baltic, sixty-one miles long, eighty-five feet wide at bottom, one hundred and ninety-six at top, twenty-eight feet deep, and estimated to cost $40,000,000. Of this sum Russia is to pay one-third and Germany the balance, and the economy to be effected is the saving of about two hundred and seventy miles and the losses incidental to a dangerous coast. Although the deepest cutting was ninety-eight and one-half feet, the average cost per mile was estimated at only $660,000.

The Amsterdam, built to replace the North Holland Canal, is but fifteen and one-half miles long, eighty-eight and one-half feet wide at bottom, and twenty-three feet deep. The total cost was $15,000,000, and its effect in stimulating the commerce of the city was pronounced.

It has been proposed to make Berlin a seaport by the construction of a ship canal, and a similar suggestion is under consideration with reference to Paris, while numerous canals of lesser proportions are projected to complete the internal water-ways of the "old country."

The attention being given to these cheaper lines of traffic, and their beneficent effects upon humanity, certainly augurs well for the future as a stimulus to increased industrial activities.

NIKOLA TESLA AND HIS WORKS.

By Lieut. F. Jarvis Patten.

In this age of practical endeavor, when everything is turned to its immediate use with the least delay possible, a life like that of Tesla, devoted to scientific research for the love of it, stands out in peculiar and interesting prominence. Such a character, however, is the natural outcome of the rapid advance in all material investigation, which has become so broad, and goes into so many different fields of research, that few workers attain to general prominence.

The last decade pays tribute to two names that have added something to our knowledge and better comprehension of nature's methods. These names are Hertz and Tesla. Hertz gave promise of showing the ultimate law that connects matter separated by space. The work so well begun was ended by his untimely death. Maxwell had shown that all of nature's reacting forces can be expressed by methods of mathematical analysis, and clearly formulated by the terms of an equation. By purely empirical methods Hertz gave physical proof of the truth of Maxwell's theoretical deductions, and so connected pure theory to practical fact.

Out of both pure theory and physical research came the general conclusion, that all manifestations of energy are but the different tangible or apparent evidences of one and the same force; that all energy, whatever its form of manifestation, is simply molecular agitation of greater or less degree. If that be true, then heat and light are merely the results of molecular agitation, and could this agitation be set up by purely mechanical means, heat or light would result.

Tesla conceived the bold idea that, by causing matter to pass to the stage of luminous vibration, without remaining for any appreciable time in the stage of heat vibration, it would produce light without heat; and so near has he come to the practical accomplishment of this conception that he

has set the scientific minds of all Europe thinking, and placed his name beside that of Hertz.

Tesla comes from Herzegovina, near the Western borderland of Turkey, and in early youth was a pupil of the government schools where he lived. Later, he held government office as a collector of statistics. His twenty-third year found him in Paris, whither he had come to study engineering at the École Polytechnique. From this school he went to the Edison Station in Paris as an engineer, where his ability was quickly recognized, and he was soon persuaded to come to this country. Here a place was found for him in the celebrated Edison laboratory. He remained in this position a few years, but, having many ideas that he wished to develop independently, he left that employ, and has since conducted a laboratory of his own in New York City, which has been devoted purely to physical research and scientific investigation.

Thirteen years' residence in this country has not deprived Tesla of his cosmopolitan character and disposition. Master of five or six languages and a devotee to broad science, he is truly a citizen of the world, a genial host and charming companion. What first brought him into prominence and gave him the means to go further, was his discovery of the "Rotary Field Motor," an invention of marked originality and beauty, but not appreciated at its full value at the time of its discovery. Announced by him and commercially disposed of in 1888, it is now just coming into general use. Simple and beautiful as it seemed, our knowledge of electrical engineering was not then equal to the task of making the machine electrically right. European engineers, however, held to the work, and, following in their footsteps, we now understand the rotary field motor, and the largest electrical enterprise in the world, the fifty thousand horse-power plant for sending the power of Niagara to light Buffalo and other distant towns, will use the multiphase system that Tesla first gave to the engineering world six years ago.

An apt illustration of the difference between the purely theoretical or scientific mind, and the semi-practical mind

guided by scientific training, suggests itself here. Professor Ferraris, of Turin, independently discovered and announced the principle and operation of the rotary field motor at about the time that Tesla did the same thing in this country. The professor's announcement was in the form of a paper to a scientific society. Tesla made many forms of the machine, reduced his theory to a practical operative device, and, having protected his invention by many patents, he exhibited his machines to the American Institute of Electrical Engineers in May, 1888. Professor Ferraris's description, however, antedates Tesla's exhibition by some months. It is worthy of remark in passing, that three of the epoch making inventions in electrical advance are of Italian origin. I refer to the chemical element, or Volta's pile; the first direct current generator invented by Pacinotti, and left in obscurity for years; and last, but greatest of all for the coming era of long distance power transmission, the rotary field engine of Ferraris and Tesla.

Before considering Tesla's more recent work, it seems appropriate to describe briefly the salient features of this machine, which can be best done by comparing it with the ordinary type of electric motor. This, in general terms, is an engine having a fixed and a revolving part, of which the latter, turning about its spindle, communicates motion to other machinery. The moving part is always provided with commutating devices that constantly shift the magnetic axis backward, in the same measure and degree that the moving part turns forward. These devices are always intricate and complex. They are, in fact, the weak point of all electric engines. The Tesla rotary field machine, being entirely free from them, is a marvel of simplicity and ingenuity. To understand this machine, one must picture a circular iron ring, and conceive it to be magnetized along a vertical diameter, North Pole at the top; then, a moment later, along a horizontal diameter, with the North Pole at the right; again along the vertical diameter, but North Pole at the bottom; and lastly on the horizontal line again, with North Pole at the left, thus completing a revolution of the North Pole around

the ring. Such an effect is called a rotating magnetic field, and can be perfectly produced by the simultaneous use of two independent alternating currents, which follow each other periodically in such a way that one has always a maximum value or strength when the other is zero, and conversely. If now the iron ring is wound all around with a coil of wire closed on itself, and one such current be introduced to this winding at the extremities of a vertical diameter, while another is simultaneously introduced to the same winding at the extremities of a horizontal diameter, they will jointly produce a revolving magnetic field that turns continuously around the ring, while the latter remains fixed in space. We then have a fixed magnet, but the magnetism itself, or magnetic axis, is in motion. A compass or magnetic needle suspended freely inside the ring would spin around in its endeavor to follow the revolving magnetism or the shifting magnetic axis of the ring.

Tesla delights in surprises for the public. He generally brings a new line of development to fair completion before giving it any public exhibition. The rotary field motor was a genuine surprise to the world of electrical engineering in 1888. Nothing more was heard from him for two years, and his motor—talked of awhile as a sort of nine days' wonder—was practically forgotten, while he was at work on other problems, of which no hint was given until his celebrated lecture at Columbia College, in the spring of 1890. In this lecture he exhibited for the first time his wonderful "high frequency effects," and certainly gave the scientific world some promise of obtaining light without heat, although this accomplishment was far from fruition at the time, and I believe is now abandoned as hopeless on the lines attempted. Still, his researches developed many new and surprising effects, which, aside from their purely laboratory interest, may have a certain commercial value. In these researches, which constitute an investigation of what have now come to be known as "The Tesla Effects," it was his aim and purpose to establish by experimental process the identity of light and some form of electrical manifestation of

energy, and he gave to science much evidence of the electro-magnetic theory of light that was new, though the theory, of course, had preceded his work, having been enunciated by Maxwell from purely theoretical deductions, and proven by Hertz by empirical methods.

Mr. Tesla started with the idea of setting matter into vibration at a rate approximating that of light (some two and a half millions a second), with the expectation that under such violent molecular agitation it would emit light. He has not as yet succeeded in obtaining so high a rate, but a much lower one produced some very surprising luminous effects. The general plan at first was this: To construct an alternating current dynamo that would produce this high rate of current alternation or pulsation. This current, now known as the "high frequency" current, will cause luminous effects in different media. Thus, in a darkened room, a bare copper wire conveying such a current will be seen to glow, and vacuum tubes will shine brightly, as a result of a molecular bombardment or agitation of the ether atoms, when such a current is sent through them under very high pressure—the very high electro-motive force of several hundred thousands of volts being used in most of his experiments of this character. The dynamo method for getting very high frequencies was soon abandoned as inadequate, and the oscillatory discharge of a Leyden jar or plate condensers was substituted. This answered much better, although the frequency was then an unknown quantity and quite beyond control; and this departure led to the discovery of some very beautiful electro-static effects, which are still being pushed by many investigators with the hope of arriving at some result of commercial value.

As soon as news of Tesla's first lecture, and the experiments there shown, reached the other side of the Atlantic, he was at once invited by various scientific societies of Europe to deliver his lecture and perform his experiments before them. This he soon did; and the scientific minds of Europe were quickly at work investigating the so-called Tesla effects, the result being that the electro-magnetic theory of light may

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be regarded as proven, while it seems equally well-established that light without heat is not to be looked for as an outcome of the Tesla effects. A beautiful and startling exhibition of what can be done with electric energy, under properly arranged conditions, is that of causing vacuum tubes or partially exhausted bulbs to glow by merely holding them between two metallic plates (about four feet square, and two or three yards apart), which are made the terminal poles of a circuit conveying a high frequency and high voltage current. It was hoped that rooms could be lighted in this way by placing the plates in the walls, where such tubes would glow without any material connection whatever with the source of energy.

Mr. Tesla claims that all electric and magnetic effects are traceable to the action of electro-static molecular forces, and in confirmation of this theory he produces what appears to be a veritable flame by the action of electro-statically charged molecules of gas. A flame is actually shown issuing from the tip of a wand, or from the ends of his fingers, which flame is devoid of heat, and by it no material is consumed. Perhaps the most surprising of the new facts elicited from his investigations is that the shock due to these very high voltage and high frequency currents can be supported by a person without any serious inconvenience. He passes a current of two hundred thousand volts through his body with perfect impunity, whereas one of two thousand volts will produce almost certain death from even a momentary shock. In one experiment, two wires are stretched parallel to each other across the room. When given the high tension current they emit streams of light, or brush discharges so profusely that light enough is produced to distinguish objects in the room. If the wires are bent into concentric hoops, one inside the other in the same plane, the annular space between them is filled with streamers that make a sheet of flame a yard or more in area.

Mr. Tesla is viewed by some as an impractical inventor—a mere visionary enthusiast—but this is hardly fair to one who has built up an entirely novel method for the experimental investigation of physical phenomena. This method, with its vast array of beautiful experiments, is original, and goes

some steps beyond any point reached by previous work in the same line. There seems to be little of practical value in it for the electrical engineer. So we may say, that to the physicist Mr. Tesla stands as the pioneer of a new and wide field of research, while before the practical man of electricity he stands as the inventor of the "rotary field machine," a beautiful and unique conception, which he soon left for the practical man to figure out.

Before the general public he stands as a phenomenal inventor from the Eastern World, from whom is expected little less than if he carried Aladdin's lamp in his hand. This view of the matter, of course, is wrong, and is an injustice both to the public and the inventor. Mr. Tesla is a hard and patient worker, and did enough for one decade in producing the rotary motor. He has doubtless much yet in store for us, but the difference should never be lost sight of between the work of the empirical physicist searching for nature's truths, and the reduction of a single result to a form for commercial use.

NEW VIOLINS FOR OLD.

By Edward Heron-Allen, F.L.S., F.R.M.S.

"The fiddles of Cremona gained their reputation by superior tone, but they hold it now mainly by their beauty. For thirty years past violins have been made equal in model to the *chefs-d'œuvre* of Cremona, stronger in wood than Stradivarius, and more scientific than Guarnerius in the thicknesses. This class of violins . . . . has one quality in perfection—power; whilst the masterpieces of Cremona eclipse every new violin in sweetness, oiliness, crispness, and volume of tone as distinct from loudness. Age has dried their vegetable juices, making the carcass much lighter than that of a new violin, and those dry frames vibrate at a touch."[1] Thus wrote Charles Reade, the novelist—than

[1] Charles Reade. "Cremona Violins. Four letters descriptive of those exhibited in 1872 at the South Kensington Museum." Gloucester: 1873, p. 28.

whom no keener follower of the violin culture ever lived—in the *Pall Mall Gazette*, of 31st of August, 1872, and though much has been written, volumes indeed, since, on the vexed question of old violins *versus* new, no writer has stated the initial dogma of the controversy with greater lucidity or honesty.

It must be remembered that this dictum was recorded in the earliest days of that mania for collecting old violins, which has since reached such portentous proportions; in the days when the masterpieces of Stradivari were readily obtainable for two or three hundred pounds, and only four months after the instrument variously known as "the Fountaine," "the Gillott," and "the Emperor" Strad. had realized at auction (at Messrs. Christie's) the sum of two hundred and ninety pounds, "amid great excitement."[1] I cite this instrument in particular, as it has recently formed the subject of a sumptuous monograph,[2] and is valued by experts at one thousand pounds. This increase in value is remarkable, but not more remarkable than the increase which had taken place in the value of the instrument since it left its maker's hands, for it is on record that Stradivari's usual price for a violin was from four louis d'or, or about three pounds ten, to about ten pounds, whilst the younger Cervetto (the violinist) himself told Simon Andrew Forster[3] that his father (old Cervetto), before he entered the musical profession, had been an Italian merchant, had dealt with Stradivari himself in musical instruments, and had brought some of his make over to England; but, as he could not obtain as much as five pounds for a violoncello, they were taken back as a bad speculation. The curious in such matters are referred to Sandys & Forster's "History," which was written in 1864, and contains the fullest details upon the then ruling prices of violins. The fact is, as Charles Reade

[1] The *Violin Times* (London, 1894). Vol. I., pp. 92 and 109.

[2] "The Emperor Stradivari. A history and description of the famous violin in the possession of George Haddock, Esq." London: 1893.

[3] W. Sandys and S. A. Forster. "The history of the violin and other instruments played on with the bow from the remotest times to the present." London: 1864, p. 227.

remarked in commenting upon the above circumstance, as recorded by Forster,[1] that then, as now, England wanted old Cremonas, not new ones. The "old Cremonas" that English and all other players preferred to the new instruments of Antonio Stradivari were, of course, the violins of Gasparo Bertalotti, called da Salo, and his followers, and the early instruments of the great Amati school. Abundant records are extant among the archives of European courts of the sums paid for such instruments for the use of the court musicians of the time.

We may, therefore, start with the assumption that the leading violin players are agreed in preferring an old instrument to a new one; and it is debatable how far they are right, and how far the victims of the time-honored beliefs that it takes a century at least to bring out the full capabilities of an instrument, and that any violin that has the requisite age must necessarily have the desired tone. Than a good old instrument, properly constructed *ab initio*, and not subsequently tampered with, nothing could be more desirable; but, unfortunately, the supply of old instruments of any kind is limited, and of old instruments unspoiled by the so-called repairs and improvements of unskilled workmen and fiddle-faddists, more limited still. It is my desire to point a middle course between the advocates of new instruments, whose testimony is too often not beyond suspicion of taint, and those gentlemen who hold that any new violin is a thing abhorrent to the artistic eye and distressful to the cultured ear. To the dispassionate observer are apparent on one side the causes which place the violin of the Cremona and Brescian schools, and of the schools founded upon them, beyond the reach of the average amateur or professional violinist; and on the other, the causes which militate in the present day against the production and appreciation of first-rate modern instruments.

A glance at the records of the prices that have been given in England and America during the past fifteen, ten, or five years for the instruments of Stradivarius, alone affords an

[1] Loc cit., p. 15.

instructive object-lesson on the first of these heads, and the financial records of some of the finest instruments in existence have, during recent years been made easy of access by the growing practice of publishing their histories in the form of monographs similar to that cited above;[1] a practice which, though affording matter of great interest for the student, is fraught with great danger to the general public, as I have on many occasions and in many places pointed out. There is a great temptation for owners of these instruments to guard them jealously from prying eyes and sacrilegious hands, and the way is thus opened for unscrupulous dealers and others to attach these monographs to inferior instruments of the same class, and dispose of them to amateurs and others in remote centres of civilization, where the chances of the fraud being discovered are relatively small. Such monographs have been issued concerning the violins known as "The Tuscan,"[2] "The Salabue, or Messiah,"[3] "The Gréville,"[4] and "The Mercury;"[5] and from these monographs we can gain a knowledge accurate in its details of the growing inflation in the prices of fine violins. "The Tuscan" was sold to an Irish amateur in 1794 for twenty-five pounds, and this gentlemen's grandson sold it in 1876 to Mr. Ricardo for two hundred and forty pounds, who in turn sold it to Messrs. Hill in 1888 for one thousand pounds. By this firm it was sold to its present owner, who is reported to have refused two thousand pounds for it. "The Salabue," which for many years was known all over Europe as "The Messiah," was sold by the heirs of Count Salabue in 1827 to Luigi Tarisio (who may be said to have "invented" the cult of violin-collecting), and he kept it unknown and inviolate until his death in 1854,

[1] "The Emperor Stradivari. A history and description of the famous violin in the possession of George Haddock, Esq." London: 1893.

[2] "The Tuscan. A short account of a violin by Stradivari made for Cosimo de Medici, Grand Duke of Tuscany." London: 1891.

[3] "The Salabue Stradivari. A history and critical description of the famous violin commonly called 'Le Messie.'" London: 1891.

[4] "The Gréville Stradivarius of 1726." New York: 1889.

[5] "Description du Superbe Violin de Stradivarius dit 'Le Mercure.'" Brussels: 1892.

when it was bought, with the rest of Tarisio's instruments, for three thousand one hundred and sixty-six pounds by Jean Baptiste Vuillaume the great Parisian maker, on whose death, in 1877, it became the property of Delphin Alard, at the price of one thousand pounds. When this instrument was exhibited at the Exhibition of 1872, above referred to, Charles Reade valued it at six hundred pounds. Alard died in 1888, and in 1890 "Le Messie" was sold to Messrs. Hill for two thousand pounds, and immediately transferred to Mr. Crawford, of Edinburgh. The history of the Gréville Stradivari, which is now the property of Mr. E. K. Adams, of New York, does not give the prices at which the instrument changed hands—which is to be regretted—and the record of "Le Mercure" errs in the same manner; but, since the pamphlet referred to was written by Mougenot the Belgian dealer, the instrument was sold by him to Mr. J. Williams, by whom it was exhibited in 1892 at the Royal Aquarium, London, where it was offered for sale at the price of one thousand five hundred pounds.[1] It would be easy, but unnecessary, to multiply examples such as the above. It may be noted while dismissing these facts that the highest price ever realized in the auction-room for any Stradivari violin has been eight hundred and sixty pounds, at which price the "Ames" Stradivari was sold by Messrs. Puttick & Simpson in 1893.

It has been to the interest and profit of chroniclers and quidnunes to record and exaggerate these figures, and a writer in the *Violin Times* has made it his pleasure from time to time to note and annihilate the ridiculous reports of violin sales that periodically find their way round the "exchanges;" but to the amateur and student of the violin—and his name is legion—the prices of violins have become a very serious problem. Arthur, Alfred and William Hill are old and valued friends of mine, we were boys together, and I have

[1] The subsequent adventures of this violin are recorded in the *Violin Times*, Vol. I., p. 53. It was offered for sale by Messrs. Puttick & Simpson, but was bought in at £500, since when it has passed into the possession of M. Tivadar Nachez, and has been advertised for sale in *The Times* at the price of £700.

sometimes reproached them for the prices with which their names are connected; but they assure me that it is through no fault of theirs, and that these prices, stagnating as they do the trade in fine instruments, are greatly to their commercial disadvantage. It is a well-known fact that on the sale of "Le Messie" violin for two thousand pounds, their profits did not amount to one cent. The instrument passed through their hands, the prestige of the negotiation was theirs, and that is all. In the case of the Stradivari violoncello, belonging to M. Batta, they paid for it fifty-one thousand francs, (two thousand and forty pounds), and sold it for two thousand two hundred pounds. It may, therefore, be conceded that in the making of such prices the dealers have had no hand. On a violin which is readily salable at three hundred pounds to five hundred pounds, a clever dealer can make a handsome profit; beyond that sum the profits become small by degrees and beautifully less. The responsibility for this condition of things lies with the great players; so long as Joachim, Sarasate, Nachez, Wolff, Wilhemj, Remenzi, and the rest of them insist upon playing only on the violins made by Stradivari, in the name of Christ. Antonio, the prices of Cremona violins will be maintained, and wax higher yet, and the modern maker will starve. I could mention a dozen makers living to-day who have received glowing testimonials for their violins from one or other of these virtuosi, but does one of them play in public on the instrument he has extolled? Not one. And the cause of this neglect, or of the postponed appreciation of acknowledged excellence, it shall be my endeavor to explain, at any rate in part.

The cause is a manifold and complicated one. I am constantly asked "Whether violins are not made to-day as good as any Stradivarius?" and my answer is invariably, "Yes." I am also asked "Whether an artist cannot produce as good a tone from a modern violin as from a Cremona instrument?" and my answer is invariably, "No." The reason of this is not far to seek. The modern violins with which the market is supplied, far in excess of the demand, come under one or other of two heads. There is the perfectly

constructed and scientifically seasoned violin, which is laboriously fashioned by the first-rate workman, and there is the trade-marked fiddle, extensively pushed and advertised, and indulgently endorsed with testimonials by leading and other players. Into the first category come the violins made by Chanot, Hill, Sylvestre, Gand, Migge, Genuïnder, and a dozen others in Europe and America; into the second come the fiddles imported from the workshops of Mittenwald, Mirecourt and Markneukirchen, fitted up and "corrected"—whatever that means—by enterprising tradesmen, and christened with fancy names by way of trade-mark. These latter often sound for the moment as well as, or better than, the skilfully made instruments of the makers above referred to, but they are not built with personal love, and their varnish—that vexed composition round which so much controversy has raged, and upon which I refuse to touch in this place—is a hard, beautiful and ephemeral concoction, concerning which silence is merciful, and contempt is just.

In dealing with the carefully and scientifically made violin I may, perhaps, be pardoned if I give a personal and egotistical example. Twelve years ago, when I undertook the production of my book on violin making,[1] I apprenticed myself to one of the greatest makers of the day, George Chanot; in his workshop I worked hard for two years and produced two violins. One of these, copied exactly from the late Prosper Sainton's Guarnerius, has been more or less continually played upon ever since, and—it may be from parental pride—I would rather play to-day upon this instrument than upon any other that has passed through my hands—not being one of the master violins to which reference has been made. But it must be remembered that few new violins have the luck, if I may so call it, to be thus played upon during the first ten years of their existence. During the last two years my violin has been played upon and submitted to every tone test by Joachim, Wilhelmj, and

[1] E. Heron-Allen. "Violin-making as it was and is, being a historical, practical, and theoretical treatise on the science and art of violin-making." London: 1884.

Wolff among other virtuosi, and they have unanimously volunteered the highest *éncomia* upon this "amateur fiddle." I call to mind another violin that has had a similar career, a copy of Maggini, made twenty years ago by George Chanot; this instrument also compares favorably at this date with the masterpieces of Cremona. It may, therefore, be conceded that, given the right initial conditions of construction, and the subsequent advantages of conscientious use, a modern violin may successfully rival any but the finest Cremonas in existence. It must further be noted that the celebrated instruments, to which I have referred, have all come down to us in practically their original "new" condition, the vast majority of Cremona instruments having been wofully cut about and tampered with during this century.

Setting aside, therefore, this curable defect of "newness," wherein lies the artistic disadvantage of the modern violin? It is, primarily, in its absolute lack of artistic *individuality;* and this results in the first place from the fact that the blind craze for age prevents the new violin from commanding such a price as will make it worth while for the modern skilled maker to devote the time requisite for the construction of violins perfect in all their parts; and, in the second place, from the mechanical perfection of modern tools and modern methods of construction. The makers of the great Italian schools worked slowly and laboriously with appliances which would to-day be considered incomplete and rough, but which brought out in their use all the innate talent of the master's hand; the maker of to-day, with his perfect mechanical and labor-saving contrivances, once he has made his moulds and models, and settled the pattern he will follow, turns out violin after violin, absolutely identical in all their parts one with another. The artistic irregularities of Joseph Guarnerius could result at the present time only from a want of manual dexterity inconsistent with good work. Individuality is lost, and violins, even the best, have come to be made with interchangeable parts like a first-class microscope or American furniture. This being the case, the door is opened for the frankly mechanical

productions of Markneukirchen and Mirecourt, which, as I have pointed out, are imported by the hundred, and placed upon the market under fictitious, fancy, and misguiding names, in defiance of the Merchandise Marks Act, 1887 (50 and 51 Vict., Cap. 28, Sect. 16), and the Custom House regulations of all nations. The conscientious maker would scorn to puff his work as these fiddles are puffed; were he to do so, he could not supply the demand so created. The average amateur, incapable of appreciating the delicacies of construction that are visible only to the practiced eye, is apt to judge the new fiddle by its price, its puff, and its unconsidered "testimonials;" and, having been lured into paying ten or twenty times the cost price of a factory-made fiddle, experiences disillusion and vexation of spirit, and returning to his tampered-with Italian violin, prefers its muffled sweetness to the noise of his "Pumpada," "Bongini," or "Guarnielli" art violin.

To conclude, let the collector of to-day profit by the experiences of the collector of yesterday. The finest violins of the old Italian schools are safely beyond his reach in the hands of the millionaire collector. Let him start anew and collect the masterpieces of the modern makers. There are fewer of these than of Cremona violins in existence, and when the wrecked instruments of Stradivari, Guarneri, Amati, Gasparo da Salo, Maggini *et hoc genus omne* have passed into the limbo of disuse, or to the apotheosis of the museum, he will be in possession of a collection that will be a rich heritage for generations yet unborn.

THE GREAT DUKE OF MARLBOROUGH.

By Sidney James Low.

Is there a Science of Biography? A Science of History is almost admitted, and some able writers in Germany, Great Britain, and America, have tried not wholly in vain to pursue it. But the scientific treatment of biography is hardly attempted—perhaps because the very idea of anything so "dry" and abstract seems repellent in connection with the most vital, the most human, the most sympathetic of studies. The method which pervades all serious intellectual effort in these times, exhibits itself in the domain of biography only in the careful collection of materials, and the rigorous analysis of evidence. No modern writer of repute would produce such a work as Scott's Life of Napoleon Bonaparte, nor perhaps one like Macaulay's Essay on Warren Hastings. He could not, it may be, emulate the graceful ease of the style of the one, the vigorous dramatic movement of the other; but neither could he build his structure on so loose and slippery a foundation, or rake together his miscellaneous mass of chaff and straw, of fact and fiction, so hastily. The old biographer let down his bucket into the depths, tumbled the contents upon his laboratory table, and out of the battered, water-worn fragments, he worked up—often, of course, with the hand of a consummate artist—the more or less life-like image of a man. The merit of the result depended chiefly upon the literary skill and imaginative power of the craftsman. If he was a genius—a Southey, a Scott, a Carlyle—you had a great work of art; if he was a mere dryasdust or pedant you might get some creaking lay-figure, with an inside of sawdust and springs of wire, to cast its ugly shadow over our libraries, till it had to be finally shouldered into the lumber-room. Good or bad, we are not very likely to have many more of such biographies as Carlyle's "Cromwell" on the one hand, or as Tomline's "Life of Pitt" on the

other. The generation which has studied its history with Ranke and Stubbs asks for a better selection of materials, a wider knowledge of the age, a more accurate grouping of facts. But the science stops here. In our estimate of character we do not often get beyond the elementary classification of the children's story-books. We want to know whether the subject of the narrative was "good or bad;" the hero of the piece or the villain; whether he did things that were in the abstract right or in the abstract wrong; whether we are expected to admire him or condemn; and we criticise the biographer according to the manner in which he supplies us with an easy answer to these questions. Some may deem that it might take the life and the fascination out of biography to do otherwise. Yet surely there is room at times for a broader treatment, and one more nearly approaching the lines we have long drawn for our guidance in the study of history. In one word, we might regard a great man less as a kind of special creation than as the result of an evolution, and the typical product of the age in which he lived. We shall find in a Napoleon, a Cæsar, a Henri Quatre, only the exaggeration or the perfection of qualities and characteristics possessed by tens of thousands of unregarded men of their time. We shall not be over-anxious either to praise our hero or to condemn him; our chief concern will be to *account* for him, and to describe his habitat, his environment, and the stage of national and ethical development which made him what he was.

Lord Wolseley, in his admirable life of the great Duke of Marlborough, certainly does not profess to be a scientific biographer; though, no doubt, when he comes to treat of Marlborough's continental campaigns he will be able to bring to bear the principles of one special science—the science of the soldier—in a fuller measure than most of those who have written on John Churchill. This, however, is to come in a later instalment of his work. The volumes before us are occupied with the earlier career of Churchill, when he was a political adventurer in an era of political adventure, an intriguer in a court and society where every one intrigued;

and here it does seem to us that the distinguished soldier, who has written the biography, takes a larger, a more just, and a more nearly scientific view than some of the distinguished men of letters who have been his critics. All admit Lord Wolseley's industry, his skill in narrative and description, his accuracy in the ordering and presentation of facts, his simple directness of style; but he is censured because he defends Churchill against the charges vehemently heaped upon him by pamphleteers and essayists in the past century, and reproduced by some great writers in this. The popular conception of Marlborough, in spite of the labors of Coxe, of Earl Stanhope, of the late Dr. Burton, and of that very ingenious writer, Mr. Paget, the author of "Paradoxes and Puzzles," is that which has been stereotyped for English-speaking readers by the genius of Thackeray and Macaulay, more especially the latter. There is no one picture in the Macaulay gallery quite so striking as the savage portrait of Marlborough. Why the great Whig historian should have cherished this furious animosity against the great Whig general, one does not quite understand; nor why the worshiper, almost to the point of fanaticism, of the Revolution of 1689, should sting and lash the man without whom the Revolution of 1689 could not have been accomplished. But the temptation to execute a masterpiece of paradoxical portraiture was too much for Macaulay's sense of justice and historic proportion; nothing could be more melo-dramatically effective than this picture of "the greatest soldier and the greatest traitor of any age," as Colonel Harry Esmond was accustomed to call him. Art is so often much more interesting than truth, and one would not willingly resign that "lurid" and impressive figure, even to do justice to the character of one of the greatest of Englishmen.

The consummate leader, so mighty in his intellectual supremacy and his Olympian calm, that the very soldiers, whose pockets he picked of farthings, admired while they hated him; the statesman, who at one moment was organizing the march of hosts and policy of empires, and the next arranging a dirty little swindle; the general, with his almost

inspired genius for war and command, and his truckling baseness of soul that knew neither loyalty, honor, patriotism, nor gratitude: this is the splendid puppet of the stage, which Macaulay has illustrated by the glaring foot-lights of his vigorous sentences, and Thackeray irradiated by the lucid beam of his charming and penetrating prose. It is not perhaps surprising to find that Mr. Andrew Lang, who, if he had lived a century and a half ago, would have drawn a claymore for the Young Chevalier, and who even now cherishes a sentimental attachment for the White Rose, cannot abide the man who overthrew the Stuarts. Mr. Lang gives praise to Marlborough's latest biographer; but he cannot agree with Lord Wolseley regarding Marlborough as a person whose character, apart from his abilities, one can admire, nor indeed does he conceal his opinion that John Churchill was other than a very gifted, conspicuous, and successful scoundrel.

In the later volumes of his book, Lord Wolseley will probably be able to show how little ground there is for the accusations leveled against Marlborough in connection with his conduct of the campaigns on the continent of Europe. It will not be difficult to show that he did not steal the soldiers' pay or add to his fortune by shabby peculation. But the heaviest charges against Churchill deal with his conduct in earlier life. We are told that he was an adventurer who took money from the abandoned woman, older than himself, who was his mistress. One recollects Macaulay's bitter sneer: "He was thrifty in his very vices, and levied ample contributions on ladies enriched by the spoils of more liberal lovers." Well, no doubt Churchill, as a young man, did take money from the Duchess of Cleveland. It was wrong; one does not defend it. The "delicacy of the present age" does not condone this particular kind of wrong-doing. But there is a fashion in vice; and in Charles II.'s reign, and long after, this species of vicious enterprise was not regarded, as it would now be, as a proof of utter degradation in a man. A fine young gentleman might be rewarded in solid coin by the lady who had granted him her favors, and not be thought entirely debased. Churchill's conduct in this

matter is not so much a proof of his personal "thrift," as of the general low standard of morals of the court and society in the latter part of the sixteenth century.

We come to the more serious points. Churchill betrayed James II., his king, his patron, his friend, to whom he owed his fortune and his advancement. It is true he did so. It is true, also, that in this desertion and betrayal of the narrow-minded bigot, who, from mere ill-conditioned obstinacy and unimaginative stupidity, was rapidly hurrying England to a civil war, he was only joining all the ablest and best English public men of the time, not to mention the king's own closest relations. If Churchill intrigued against James II., abandoned him in the crisis of his fate, so did James's own daughter and his son-in-law; so did men like Lords Clarendon, Rochester, and Cornbury, who were connected with him by closest family and personal ties; so did the real leaders of the English governing classes, the great nobles, like Halifax, Nottingham, Danby, Shrewsbury, Russell, Sidney; so did Sunderland, James's trusted minister and adviser. But we may be told, Mr. Lang, in fact, tells us, that this makes the matter no better for Churchill. He is none the less a traitor because a great many other people were traitors too. Treachery and falsehood were in the air, but John Churchill took the infection, and has to suffer for it.

That Churchill, in company with the other Whig and Protestant leaders, did deceive and betray James is undeniable. So far as Churchill himself is concerned the evidence is clear that it was done very reluctantly, and only under an overmastering sense of the danger which the Protestant religion would incur if James II. were not dethroned. It is plain to anybody, who will take the trouble to read Marlborough's letters with candor, that the strongest passion of his life, next to his love for Sarah Jennings, was his devotion to the Church of England and the Protestant religion. When it became clear to Churchill, as it did to the other leading Whigs, that the king was obstinately bent on restoring the Roman Catholic religion, what were they to do? Mr. Lang says there were three courses open. Marlborough

might, in the first place, have resigned his offices and gone into private life; or he might have openly and instantly abandoned James and publicly declared for the Prince of Orange, and a change in the succession; or he might, like Mr. Lang's favorite hero, Dundee, have preferred his loyalty to his religion, his king to his God, stood by James to the last, and, if necessary, died fighting for the faith that was not his own, and earned a hero's grave, as Dundee did at Killiecrankie.

Now, if these three courses had occurred to Churchill, as no doubt they did, he must have seen that there were considerable and perfectly valid and insurmountable objections in each case. Mr. Lang's prescription for regulating the conduct of a public man in a public crisis is generous, honorable, full of chivalry; but, if one may say so, it is not business. *C'est magnifique mais ce n'est pas la politique.* Luckily, on the whole, the men to whose fate it falls to mould and form the destinies of nations do not often act with their biographies in their mind. They have to do the rough actual work—business of the world, not to pose gracefully before posterity, or to wear the white flower of a stainless historic life. And fortunately, too, they have some of the sentiment of the faithful old Scotch servant who refused, on his death-bed, to tell the truth on a subject which reflected on the honor of the family he served. "What matters my own soul, if I save the honor of the family." Marlborough, it is true, might have saved his own soul at the low price of possibly ruining England and destroying the Church. He might have resigned his offices, gone off to his estate, lived comfortably on the moderate fortune he had already amassed, and left others to save England, if they could. In fact, he might have shirked. It does not strike one as very heroic to leave your country and your religion to go to destruction, so that you may "keep the bird in your bosom," and not have to wear a double face, and do things which a person of scrupulous honor cannot approve. Suppose Churchill had done that —and if Churchill, why not Shrewsbury and Halifax, and the Archbishop of Canterbury, and the Bishop of London,

and the other leading men who plotted to bring over William of Orange? If they had acted in that fashion, William of Orange could not have become king, at any rate not peacefully; James would have re-established Roman Catholicism, and supported it by an army of Irish mercenaries; years of desolating civil war might have thrown England a century back in the scale of civilization, have checked the commercial and industrial development of the country, and have rendered it unable to cope with France, Spain, and Holland in the race for maritime and colonial supremacy. As far as one can see, the history not of Britain alone, but of the whole Anglo-Saxon race, might have been altered for the worse, if the ruinous attempt to put back the religious and constitutional movement to Tudor conditions had not been speedily and effectually defeated. Surely it was worth sacrificing the private honor of some score or so of statesmen, courtiers, and prelates, to gain such results. Archbishop Sancroft and Bishop Compton thought so; and they were two of the most honorable and respected churchmen of the period.

But if it were right to resist James, why need they plot against him in secret? Why, in plain words, deceive and betray him? They might have taken the second of Mr. Lang's alternatives—open abandonment of the king, and a public declaration in favor of the Prince of Orange. But "he who desires the end desires the means." The Whig statesmen were more anxious to save the country than to cherish their private honor. If they had openly declared for William they might have filled a nobler place in the pages of moralist or poet. Mr. Lang, perhaps, would have poured over them some of the beautiful sentences in which he deplores the untimely death of Dundee. "Better and more desirable is the tomb in the kirk of Old Deer than all the luxury of Blenheim." Perhaps; but if it was good and desirable to save Britain from a papal tyranny or from civil war, then Churchill and his co-conspirators went the right way to work. To declare publicly for William would have spoiled the whole game. Marlborough would probably have been sent to the Tower, and his and some half-dozen of

the noblest heads in England would have fallen on the scaffold. James, forewarned and forearmed, could have secured the army by a wholesale expulsion of Protestant officers, and the peaceful progress of William would have been a series of bloody campaigns. We cannot blame the men of the Revolution that they chose to sacrifice their loyalty to preserve Britain from this calamity; or whether we blame them or not (and after all I do not know that it is the historian's business to deal much in praise or blame), we may at least recognize that they went to work in the right way to secure the end they had in view—an end which even the partisans of the White Rose, like Mr. Lang, admit to have been a good one. James, when once his determination to restore Catholicism was manifest, was clearly impossible—a danger not only to the liberties, but to the order and unity of the kingdom. Marlborough's estimate of the situation is stated with perfect frankness and clearness in the letter he forwarded in May, 1687, through Dykvelt, the emissary of William of Orange, who came to London to sound the leading men about the court. "I thought it my duty to your Highness and the Princess Royal, by this opportunity of Mr. Dykvelt, to give you assurances under my own hand that my places and the king's favor I set at naught in comparison of the being true to my religion. In all things but this the king may command me; and I call God to witness that even with joy I should expose my life for his service, so sensible am I of his favors. I know the troubling of you, sir, with thus much of myself, I being of little use to your Highness, is very impertinent; but that I think it may be a great ease to your Highness and the Princess to be satisfied that the Princess of Denmark is safe in the trusting of me, I being resolved, though I cannot live the life of a saint, if there be ever occasion for it, to show the resolution of a martyr." Macaulay says that the elevation in the style and language of this letter is a sure proof that Marlborough, when he wrote it, contemplated some deed of unusual baseness. Readers less prejudiced will probably think that it says what it means, and that its meaning is natural and jus-

tifiable. If James seriously set about to overthrow Protestantism, Marlborough felt himself bound to do his best to overthrow *him*. James persevered in his mad enterprise, and Churchill and his friends determined to drive him from the throne. The way to do that, with as little bloodshed and disturbance as possible, was to conspire secretly with the Prince of Orange. Conspiracy is not a nice business to be engaged in. Nor is homicide; but the soldier sometimes has to save his country by killing—not always in hot blood—and the statesman, in certain conjunctures, may have to serve a cause he holds sacred by what, in other circumstances, would be perjury and deceit. "Had Churchill," says Mr. Lang, "*instantly* quitted his service when he saw James's intentions, or had he gone over to Holland, or had he joined Dundee, many a blow would have been struck, and the end no man can guess." Exactly; and this is surely sufficient vindication of his treachery—sufficient, at any rate, from the point of view of the historian, who is interested in men chiefly as they are the working parts of a great movement, whatever it may be from the standpoint of the higher morality who thinks that a statesman is entitled to save his own soul at the cost of his country's ruin.

If that is the explanation of Churchill's betrayal of James II., it is otherwise with his treachery to William during the first years of that king's reign. The apologist of Marlborough finds it hard to account satisfactorily for the correspondence his hero undoubtedly kept up with the exiled James. Those who are not concerned to represent Marlborough as a perfect character, or to defend all his actions, may admit frankly that he tried to keep up with the late king simply because it was not certain that there would not be a Jacobite restoration, and, if so, he was anxious to be on the safe side. It was not likely, but it was possible; and most of the leading men of the time, as well as Marlborough, tried to "hedge" by cultivating a little interest with the court of St. Germaine. It was a shabby and dishonorable series of transactions, and is not mitigated by the considerations which excuse the plotting against James. For those

who must have a great man, good all through, or bad all through, it must be difficult to admire Marlborough, with the knowledge that he followed up the excusable treason which set William on the throne by a baser treason, which had no other object but that of saving his own head and fortune, in certain not wholly improbable contingencies. But we do not expect flawless perfection in our friends, exposed as they are, as a rule, only to the comparatively less searching tests of private life; we need not look for it in our heroes, tried by the severe strain of war, command, or statesmanship. Marlborough may have acted, under what I believe to have been a high and sound sense of public duty, with ingratitude to the prince, to whom he owed much; he may, with more ignoble motives, have intrigued against the king he helped to place upon the throne; but if we care to weigh his character in the scales, and to balance good and evil, we may remember that he was kind to his friends, and forgiving to his enemies; that if the soldiers idolized "Corporal John," it was not solely because of his unbroken success in battle, and his Jove-like tranquillity on the field, but also because he showed a real desire, rare enough among the commanders of the seventeenth and eighteenth centuries, to secure the well-being and comfort of his troops; and that in a loose and licentious age he was the truest and most devoted of husbands. Something too much has been made of Marlborough's faults and failings. One is glad to find that his latest biographer, while admitting his errors, is more intent to explain the circumstances, the training, and the characteristics, which made Marlborough what he was.

"It is not," says Lord Wolseley, very justly, "to censure his amours, to despise him for his niggardliness, or to hate him for his double-dealing, that we wish to study Marlborough's character and to follow his career. We do so because we desire to learn the secret of his success, and to discover the motives of his actions. We wish to know how he so contrived to carry public opinion with him for nearly ten years, that he was able to direct our foreign policy, and to shape our history. Had he failed in this, not even his

genius for war could have won for England that foremost position in Europe to which he raised her. When the whole civilized world rang with his name, when kings and princes sought his advice, and were proud to obey his orders, we still more want to know what was the spirit within him that urged him on. There must have been some strange power in the man who was able to endow his country with such power and influence whilst he ruled her and guided her destinies." What the "strange power" was, how it grew, and how it worked, it is for biography to discover and explain—if biography is to be anything much better than good-natured eulogy and malicious gossip.

THE RIGHTS AND WRONGS OF TOAD-STOOLS.

By Charles McIlvaine.

Toad-stools have powers far beyond those indicated by their humble position in plant society. No other vegetable growth is so intimately interlocked with the welfare and ills of the human race. As ferments in yeast, wines, and beer, they are, in their microscopic kinds, of inestimable value; as causes and promoters of various diseases of food-giving plants, and of the human organism itself, they do untold damage.

A few sympathetic and authoritative pens have excited great popular interest in toad-stools as a food supply—one plentiful, healthful, and everywhere abounding. These writers, who years ago delved into the toad-stool family after species to delight their palates, found many hundreds of attractive shapes, and themselves most amply rewarded in almost as many hundreds of edible, delicious kinds, nearly all of which had been heretofore despised as food, and kicked as virulent, hereditary enemies to man.

It is not certain, however, that the interest exciting friends for toad-stools has not disproportionately increased the number of their enemies. There is a valid reason for the doubt.

The toad-stool lover is forced, because of his careful and honest regard for the lives of his fellows, to declare at the very outset of his plea for toad-stools as a plentiful and healthful food, that the woodland of every country is filled with species of a family which is deadly when eaten. Whenever he proclaims the many virtues of his pets, he is forced to head his proclamation with the capitals, BEWARE!

And further, while he feels quite safe himself in his selection for and eating of dainty meals, made sure by systematic testing, and lack of all foolhardiness in eating, he is by no means sure that others will go slow, and intelligently make selections. The only safe way for the amateur is to taste a small piece of an unknown variety. If it commends itself to sight, taste, and smell; if no unpleasant after-effects occur; then taste a larger piece, cooked without pepper or salt. Test on, increasing the quantity until a full meal is eaten, or the first symptoms of disagreement occur. These will speedily disappear after taking a wine glass of vinegar and sweet oil, or whisky in place of the vinegar.

Many species of toad-stools are unfitted for eating by their texture. The polyporei, always found growing from wood, are with one or two exceptions too tough for food. Some of the clavariei—club-shaped, branched fungi, growing from the ground—are stringy; many of the varieties are delicious, none are poisonous. Among the boleti, the species of polyporei having under the cap tubes which are detachable from the cap, and which always grow upon the ground, there are some too bitter to eat, and this bitterness cannot be cooked out of them; others, from the length of their tubes, make a slimy dish. This can be avoided by removing the tubes before cooking. Among the lycoperdons or puff balls, there is not a single species which is not tender and delightful in flavor, but they must not be eaten when water-soaked or discolored inside; in such a condition they are extremely bitter. There is one variety of lycoperdon found in the woods, and in great quantity under beech trees—the scleroderma vulgare —which has a bluish-black interior. It is excellent so long as it is firm.

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After many years spent in investigating the edible qualities of the afore-mentioned species, and eating of the many varieties I have found, I have failed to find a single one that has given me the slightest indication of possessing poisonous qualities. It may be that the bitter sorts contain a minor poison, but, as no one can eat them, there is no danger from them.

It is in the Order of Agaricini that by far the greater number of edible toad-stools are found; and it is in this Order that the deadly species exist. The spore-bearing surface of all agarics is under the cap, and consists of gills radiating from the stem to the edge of the cap. It is called the hymenium. The agaricini constitute the first Order of fungoid growth.

Standing at the very top of the Order and of all toad-stools, beautiful, seductive, pretty as any of dame nature's products, is the aristocratic Amanita. It is there by comparison.

If we, as typical personages of the highest race of men, were not white-skinned, white-productive, we would not be inclined to place our similars among toad-stools at the head of their kind.

The amanita family are many-colored in the caps they wear; they are many-figured in their statuesque bearing; but they are always white under their caps, white in their gills, and white in the spores or seeds they bear, and which they shed from these gills to reproduce after their kind. Age often mellows the color of the gills to a lemon yellow, and the whole plant emits a smell unpleasant to those who object to that of the polecat. The seeds remain white, and can be caught by placing the cap, gills downward, upon paper or glass.

There are between thirty and forty distinct species of amanita; of these probably not over eight are poisonous; the others are among the very best of the edible kinds.

Notwithstanding that the common mushrooms—the *Agaricus Campestris*, and *A. Arvensis*—bear dark purple spores, and that their gills change from a light pink in youth to almost black in age, the amanita very closely resemble them in the early stages of their growth. It is because of this

close resemblance that fatal mistakes occur in gathering them; and these mistakes are generally made by those who think they know the common mushroom. To those initiated in the botanic marks of toad-stools, the differences are as plain as between black and white. The principal objects of this article are to point out these differences, and to instruct the physician in what to do if called upon to treat a case of amanitine poisoning.

In addition to the difference in color of spore and gill, there is the difference of habitat; the amanita grows in the woods, the common mushroom never does. I have never found an amanita growing in the open field. They frequently do grow along the edge of woodlands, and upon ground recently cleared of timber. Their proper habitat is in deep woods.

Now, to tell more definitely about its growth. All toad-stools, of whatever kind, grow from what is called mycelium, —a vine cellular in its structure, and reproducing cells, endwise. Upon this vine a knob or conglomeration of cells is formed. This knob, not larger than a pin-head, is the earliest form of the baby amanita. Moisture, warmth from sunlight, favorable conditions of soil created thereby, are invigorating and cell-producing to the nodule. It swells within its baby-wrap. Rain comes. Wonderful is its growth and development! By simple increase of cells in a way not short of intelligence, it bursts beyond its surroundings; puts its progressive head above the soil, carrying with it fragments of its former wrap, which adheres to its cap in the shape of scales or warts; leaves the rest of it in its ground-cradle as a volva about its base, and soon stands upright upon a stem composed of self-elongating cells, a perfect amanita, excepting one thing: the cap is to become the parent of future generations. To prevent it from becoming a mother too soon, a membrane is stretched from the stem to the outer edge of the expanding cap, and over the entire hymenium. This is called the veil, and shields the gills until other cells, thrown out from their surfaces and in some way converted into seeds, are ready to be cast off as perfect, ripe. As the

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cap spreads, this protecting veil is torn. Its stem-hold being the stronger, the tear occurs at or near the rim of the cap; the veil falls back to the stem, and there hangs as an annular ring or veil. Such, not to be mistaken, are the characteristic marks of the amanita; a volva at the base, a ring or veil about the upper part of the stem, white gills, white spores, and remnants of the ruptured volva on top of the cap. These distinctive marks are on some species so delicate in their structure that they disappear soon after the plant has reached its growth (excepting the color of the spores); they are evanescent. Yet to the practiced observer, the remains of the volva upon the cap—indicated by thin dried scales—the stain of the veil about the stem, the semblance of a sheath about the base of the stem, and a slight ridge where this sheath was adnate to the stem, are infallible guides. It is highly important that physicians and others interested should familiarize themselves with these toad-stools. They can be found in the woods at any time, in the latitude of Philadelphia, from the first of May until frost puts an end to their coming.

The common mushroom has a downy adpressed scurf on top of its cap; it has a veil or ring about its stem; but its stem ends abruptly in a bunch of thread-like roots; it has not a volva. It does not grow from a sheath.

There are among species growing in the woods those that will effect delicate digestive apparatuses unpleasantly. They, one and all, have a soapy taste when raw or cooked, which generally arises from the presence of an oxalate of potash. There are probably other minor poisons present which have not yet been segregated. Unpleasant effects from eating such varieties will be experienced almost immediately after the meal, just as from any indigestible or unhealthy matter. Relief will be at once experienced by taking an emetic and using the simple remedy stated. The writer has eaten full meals of over four hundred species of toad-stools, and has never had to resort to a remedial agent, unless he purposely tested a species far enough to be certain that it contained a poison.

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The physician called in to administer to a patient supposed to be poisoned by toad-stools, is enabled to draw a sharp line as to what poison is at work, by the time elapsing between the eating and the appearance of sickness. The poison of the amanita shows no effect whatever under eight hours. The first symptom is shown in an ashy pallor and peculiar grayness of the eye. This is immediately followed by what resembles a violent attack of cholera-morbus, together with a foul breath, which must be guarded against by ventilation of the room, or poisoning to all present will result. Gastro-intestinal troubles follow, insufferable tenesmus, coma, death, in from forty-five to sixty-five hours after the ingestion of the meal, unless the specific remedy is heroically administered. Emetics and stimulants are useless, worse than useless, at the outset of the attack.

In October, 1885, my attention was drawn, through the public press, to five cases of toad-stool poisoning in Shenandoah, Pennsylvania. Being anxious to gain all possible information about them, I wrote to the physician in charge of the cases, Dr. J. E. Shadle. I was able to obtain through him samples of the toad-stools eaten, collected by one of the survivors of the poisoning. I at once recognized the Amanita vernus, and the Amanita bulbosus. I was extremely fortunate in applying to such an intelligent and highly accomplished physician as Dr. Shadle. He, knowing that a toad-stool poison was at work in his patients, remembered that sulphate of atropine had been indicated as a possible antidote. As a last resource, he began using it, and thereby saved the lives of three of the five persons. I was enabled to designate the special poison at work, and Dr. Shadle was well fortified in his statement that the sulphate of atropine was the antidote. I have since repeatedly tried the effects of the amanitine poisoning upon myself, and upon animals, and have not failed in a single instance permanently to eradicate its effects. For the first time, in these cases, the antidote was brought into contact with a known toad-stool poison, amanitine, in the human system. For a full report of these cases and their treatment by Dr. Shadle, see "Amanitine and its Antidote"

(McIlvaine, *Medical and Surgical Reporter*, December 12 and 19, 1885); also, "The Deadly and Minor Poisons of Toad-stools" (McIlvaine, in *The Therapeutic Gazette*, May 15, 1893). This article has been reprinted in pamphlet form by the publishers of *The Therapeutic Gazette;* and the first article mentioned has been included with several valuable ones upon edible fungi, in "About Mushrooms," a book quite recently issued by Lee and Shepard, Boston, from the experienced pen of Mr. Julius A. Palmer.

It is possible that with toad-stools immediately affecting the digestive apparatus, some of the amanita may have been eaten. Therefore, all cases of suspected toad-stool poisoning should be carefully watched for the appearance of amanitine poisoning until the assigned time is safely passed.

Upon the first showing of a single symptom of amanitine poisoning, as described, one-sixtieth of a grain of sulphate of atropine should be subcutaneously administered; and the same dose should be given at short intervals, until the one-twentieth of a grain has been absorbed or the effects of the poison have been counteracted. Heroic action is absolutely necessary.

QUERIES IN LITERATURE: WHY DO CERTAIN WORKS OF FICTION SUCCEED?

By Marrion Wilcox.

In Hermann Oldenberg's scholarly work, "Buddha: Sein Leben, Seine Lehre, Seine Gemeinde," we come upon the statement (p. 204. Berlin: 1881), that Buddha's last illness was occasioned by eating pork, which Cunda, the son of a goldsmith at Pâvâ, set before him.

The naïve passage is embedded in texts of rare beauty, citations from the ancient literature of India, describing Buddha's ideal life, and recalling Sir Edwin Arnold's smoothest verses in "The Light of Asia," and it is as truly in its right place in this German prize-crowned prose study, as it would

be out of place in an English poem. As such real things in books have a way of doing, it starts an inquiry, and this inquiry turns upon the cause of popular success in literature—a publisher's mystery and embarrassing problem of those who promote the most esteemed of arts. That dish of pork is as much a part of the subject, in a book treating of Buddha, as is the doctrine of nirvâna. Is the secret of success, then, to be found in the choice of subject? Apparently not.

Within our memories such books as these have scored popular successes:—a book that has realized people and scenes at the time of Christ and in Palestine (Wallace's "Ben Hur"); a book that unsparingly dealt out sorcery and adventure in an unexplored region of Africa (Haggard's "She"); books that glimpsed provincial Scotch people from little Presbyterian windows (Barrie's stories); books that dissected delicate vice in Rome—in Paris ("Cosmopolis"—"Sappho"); hazardous tales of a Mr. Barnes, of New York, not less than of the Wandering Jew made seemly as a "Prince of India;" grave religious questionings of Mrs. Humphrey Ward; unmitigated reek of French pot-houses in "L'Assommoir" and of French peasants in "La Terre;" nebulous aspirations, maidenly adumbrations from an "African Farm;" the New-World, dandyish social cares of "Van Bibber;" the narrative result of a German scholar's research into the life of an Egyptian Princess; South-European temperaments disclosed by Thomas Hardy in depiction of English milkmaids; with Tolstoï's evocation, volumes of shaggy-brooding Russians; Spaniards who discourse of love, the church and again love for Valéra; at Howells's bidding, groups of sincere and witty Americans; bluff Anglo-Indian soldiers sympathetically dispersed among civilians of all lands by Kipling; a romance illustrating the good and evil spirits that strive in every man—even a comely "Dr. Jekyll;" novels of modern Hebrew life by Besant and Zangwill; volumes of Warner's fine fancy and humor; a chilled and snowed-in love affair among coughing unfortunates in a Swiss mountain sanitarium; and now, as a long serial in a popular magazine that knows the public, if any magazine does, an artist's story of a Parisian model with her

English, Welsh, Scotch, and nondescript admirers. Any reader can extend the list, and perhaps every reader will complain that his favorites have been omitted. Well, the names have been set down rapidly, and in the order in which they have come to mind; and merely to illustrate the point that the subject does not make any difference. It sounds more temperate to say, "The subject does not make *the* difference;" so let the conclusion take that form. And, of course, neither does the school of writing make the difference. Leaders of romanticism, realism, idealism, are all in the list.

The conclusion would seem obvious enough; and yet one of the great publishing houses recently lost an author, whose novels have gained immediate and general approval, because a trusted reader for the house reported that the first work submitted by that author was "too Scotch!"

It is noteworthy that two or three of the books referred to above are scarcely in Literature at all; that is to say, it is already apparent that they are just good "yarns," insufficiently equipped with the artistic qualities that make work permanent; and such accidental and temporary successes may be left out of the account. Aside from these, are there any qualities, or is there any quality, common to all successful works of fiction, and so essential that we may say, in judging an untried work: "This novel, or this romance, will succeed because it has such-and-such a quality?" It is the writer's intention to make respectful inquiry, not to put forward a pretentious assertion. But, if the secret of success is not in choice of subject, nor yet in adhesion to the doctrines of any school in authorship, what can it be except insight—the faculty of seeing attractive things beneath whatever unattractive, unfamiliar, indifferent exterior the subject may present to the great public?

A pretty example of insight, directed by womanly sympathy, is at hand. Henry James, writing in 1887, invited public attention to the fact that a woman of Northern birth had been the first, or among the first, to feel the "voicelessness of the conquered and reconstructed South," and to give literary expression to certain aspects of life, after the war in

Florida, Georgia, and the Carolinas. As the fruit of a remarkable minuteness of observation and tender feeling, her stories, said Mr. James, have a high value, especially when regarded in the light of the *voicelessness* of the conquered and reconstructed South. Miss Woolson strikes the reader as having a compassionate sense of this pathetic dumbness, having perceived that no social revolution of equal magnitude had ever reflected itself so little in literature, remained so unrecorded, so unpainted, and unsung. She has attempted to give an impression of this circumstance among others, and a sympathy altogether feminine has guided her pen. She loves the whole region, and no daughter of the land could have handled its peculiarities more indulgently, or communicated to us more of the sense of close observation and intimate knowledge.

Recently, Henry M. Alden, in the course of some very beautiful comments that were called forth by Miss Woolson's tragic death, said that the Southern life, after the war, had appealed to her very strongly, and that she had given it form and voice before the South had produced writers of its own, like Cable and Page and Harris and Miss King.

As a lover of the South, and of books dealing with the scenery and temperaments that have the Southern charm, the writer has been led by Mr. Alden's article, recalling Mr. James's, to examine once again the novels by Miss Woolson that have given so much pleasure to so many people, and to note some of the characteristic passages.

Here, in "East Angels," are memorable paragraphs in which she touched, with the caressing hand of an artist, the scenery of Florida:

"The stream was bringing them toward a bower in the heart of the Monnlings, or rather a long defile like a chink between two high cliffs, the cliffs being a dense mass of flowering shrubs.

"Winthrop made no comment as they entered this blossoming pass, Margaret did not speak. The air was loaded with sweetness; she put her hands on the edge of the canoe to steady herself. Then she looked up as if in search of

fresher air, or to see how high the flowers ascended. But there was no fresher air, and the flowers went up out of sight.

"The defile grew narrower, the atmosphere became so heavy that they could taste the perfume in their mouths. After another five minutes Margaret drew a long breath—she had apparently been trying to breathe as little as possible. 'I don't think I can—I am afraid—' She swayed, then sank softly down; she had fainted.

"He caught her in his arms, and laid her on the canoe's bottom, her head on the cloak. He looked at the water, but the thought of the dark tide's touching that fair face was repugnant to him. He bent down and spoke to her, and smoothed her hair. But that was advancing nothing, and he began to chafe her hands. Then suddenly he rose, and, taking the paddle, sent the canoe flying along between the high bushes. The air was visibly thick in the red light of the torches, a miasma of scent. A branch of small blossoms with the perfume of heliotrope softly brushed against his cheek; he struck it aside with unnecessary violence. Exerting all his strength, he at last got the canoe free from the beautiful baleful place."

In the following extract from "Jupiter Lights," the point of view, still intensely Southern, is moved across the river that divides Florida from Georgia:

"The Atlantic was very calm, its hue was emerald green; it was so clear that one could see the great jelly-fish floating down below. The judge, with his hands clasped on his cane's head, stood looking eagerly at everything. His joy was deep; he felt himself an exile returning home. And oh, how beautiful home was! To him, this Southern coast was fair as Paradise; he welcomed the dark hue of the Southern trees; he welcomed the neglected fields; he even welcomed the broken-down old houses here and there. For at least they were not staring, they were not noisy; to the judge the smart new houses of Port-aux-Pins—those with Mansard roofs—had seemed to shout and yell. Three negro fishermen, passing in a row-boat with a torn sail, were eminently worthy creatures; they were not impudent, well-dressed mulattoes of the

North, who elbowed him off the pavements; who read newspapers on steamers with the air of men of the world. When the winding channel—winding through water—came to an end at the mouth of an inlet, the white sand-hills on each hand were more beautiful to his eyes than the peaks of the Alps or the soft outline of Italian mountains. 'God bless my country!' was the old man's fervent thought. But his 'country' was limited; it was the territory which lies between the St. Mary's River and the Savannah."

Very perfect is the contrast offered by the two passages which follow, of which the first is taken from "Jupiter Lights," and the second from "In the Cotton Country"—a story in the volume entitled "Rodman, the Keeper:"

"Eve replied: 'You are the most extraordinary people in the world, you Southerners; I have been here nearly a month, and I am constantly struck by it—you never think of money at all. And the strangest point is, that, although you never think of it, you don't in the least know how to get on without it.'"

So much for the easy and breezy Northern view of Southern distress after the war. Now mark the heavy, anxious, weary tone in a Southerner's view of the same conditions:

"'Down here in the country we were rich once, madam; we were richer than Northerners ever are, for we toiled not for our money, neither took thought for it; it came, and we spent it; that was all.'"

And this, from "Old Gardiston," is so intimately true of the private life of the distressful period that, if it had been written by a Southerner, it would seem like a confession and self-revelation:

"Gardis brought out some of the half-year rent money, and a dinner was planned, of few dishes truly, but each would be a marvel of good cooking, as the old family servants of the South used to cook when time was nothing to them. It is not much to them now; but they have heard that it ought to be, and that troubles the perfection of their pie-crust. There was a little wine left in the wine-room—a queer little

recess like a secret chamber; and there was always the crocodile china and the few pieces of cut-glass. The four forks would be enough, and Gardis would take no jelly, so that the spoons would serve also; in fact, the dinner was planned to accommodate the silver. So far, so good. But now as to dress; here the poor little mistress was sadly pinched. She knew this; but she hoped to make use of a certain well-worn changeable silk that had belonged to Miss Margaretta, in hue a dull green and purple. But, alas! upon inspection she discovered that the faithful garment had given way at last, after years of patient service, and now there was nothing left but mildew and shreds. The invitation had been formally accepted; the dinner was in course of preparation; what should she do? She had absolutely nothing, poor child, save the two faded old lawns which she wore ordinarily, and the one shabby woolen dress for cooler weather. 'If they were anything but what they are,' she said to herself, after she had again and again turned over the contents of her three bureau drawers, 'I would wear my every-day dress without a moment's thought or trouble. But I will not allow these men, belonging to the despot army of the North, these aliens forced upon us by a strong hand and a hard fate, to smile at the shabby attire of a Southern lady.'"

This is all true to life; it is artistic, and sincere as heart could wish. Could a daughter of the land (to revert to Henry James's expression) have handled its peculiarities more indulgently or communicated to us more of the sense of close observation and intimate knowledge? By the way, this is what Miss Woolson said about one of the daughters of the land; she described Bettina Ward as "a girl, young and dimpled and dewy; one of the creamy roses of the South that, even in the bud, are richer in color and luxuriance than any Northern flower." In future histories of American literature will the Northern gentlewoman, born in New Hampshire, educated in Cleveland and New York, be recognized as one of the earliest and one of the most sympathetic delineators of Southern life after the war?

CURRENT SCIENTIFIC DISCUSSION.

By Prof. Angelo Heilprin,
Academy of Natural Sciences of Philadelphia.

THE ORIGIN OF LAKE BASINS.

In a series of articles published in recent numbers of the *Fortnightly Review*, Mr. Alfred Russell Wallace sums up in a forcible manner the evidence and arguments in favor of the glacial origin of lake basins. These papers, while they are by no means conclusive in their argument, are, without question, the ablest presentation of the case from the point of view of the glacialist, and merit the attention of all geologists. Mr. Wallace is an uncompromising follower of the late Sir Andrew Ramsay, but he holds to a line of argument very different from that of the distinguished geologist who first propounded the theory which has latterly been subjected to such warm criticism. Mr. Wallace's effort has been to show:

1. That valley lakes of highly glaciated regions, such as the Alps or Great Britain, for example, are of a markedly characteristic or distinct class, since such lakes are almost everywhere wanting in the mountainous tracts of non-glaciated regions.

2. That the deeper contours of such lakes—their flat or saucer-shaped floors, extreme depths (in some cases, as in the Swiss and Italian lakes, measuring one thousand or two thousand feet, or more), and nearly even borders—are such as could be explained only on the assumption of glacial scour.

3. The insufficiency of the rival theory of mountain deformation or submergence—the view that is held by Bonney, Desor, Forel, and Favre—which, while it might sufficiently explain the existence of certain lakes, could not account for the remarkable inequalities of depth, and for the general

grouping around and about mountain bases. The final position is thus stated: "On the whole, I venture to claim that the facts and considerations set forth in this paper show such a number of distinct lines of evidence, all converging to establish the theory of the ice erosion of the valley lakes of highly glaciated regions—a theory first advocated by the late Sir Andrew Ramsay—that that theory must be held to be established, at all events provisionally, as the only one by which the whole body of the facts can be explained and harmonized."

Mr. Wallace, in common with many scientists, makes the mistake of holding firmly to a provisional theory pending the discovery of one that more nearly meets the case. It may be asked, wherefore? A theory that "best" accounts for anything is of little value unless it is supported by hard facts; it then, and only then, becomes convincing. A negative agreement with conditions and facts—*i. e.*, a theory which is seemingly best because there is little or nothing in conflict with it—remains negative. The question in the premises, in the problem under consideration, is one that touches primarily the mechanics of glaciers—their power as eroding agents. Mr. Wallace, it seems to us, has so ably stated his general proposition, that, recognizing the all-sufficiency of glaciers to do that work which is asked of them, it is almost impossible to avoid the conclusion which has been reached by that naturalist. But it is just this work which is denied by many competent observers—geologists and geographers; not only is the power to excavate rock-basins denied to the glaciers, but even that of hollowing out basins in comparatively loose and friable material. And it is an indisputable fact that some of the largest sheets of moving ice have been found to mount over gentle inequalities of their bed—even loose stones—rather than remove them from the surface. Such a practical glacialist as Mr. Douglas Freshfield indeed holds—and he is supported in his views by a number of geologists—that the glaciers are really protectors of terrains rather than destroyers of them; and he asserts, as a result of years of experience among the ice-rivers of Europe and Asia,

that glaciers, while they burnish and smooth rock-surfaces, are entirely incapable to do the work of excavation. No excavating of any amount was observed by him. Mr. Wallace ingeniously meets this deficiency of evidence by assuming that, with a long duration (thirty thousand years) of the Ice Age, the rate of erosion need not have been more than an inch a year to account for the shaping of lake-hollows of two thousand five hundred feet depth, such as we find in the deepest of the Italian lakes (Laggo Maggiore). Of course, no such minimum scour could ordinarily be detected in a glacier. But the amount of scour could readily be increased ten times, or even twenty times—to ten or twenty inches annually—and still nothing would be made apparent to the ordinarily observing eye, since, even if we assume the working power of a glacier to be restricted to six months of the year, the daily excavation would be so slight (about one-ninth of an inch) as entirely to escape detection. Reducing the length of the glacial period to one thousand years, this minute invisible work could still account for the depths of nearly all known lakes. Mr. Wallace has not yet proved his case, but his line of argument is such that it cannot readily be brushed aside. The comparative study of the contours and bottoms of assumed glacial and non-glacial lakes would solve the question definitely.

IS THERE A WILD CAMEL?

Among the zoölogical trophies brought back by Mr. St. George Littledale, from his recent remarkable journey across the heart of Asia, are the skin and skeletal parts of a species of camel, which, seemingly in considerable numbers, and without owners, roams wild over the western parts of the Desert of Gobi. The existence of this camel was first made known by the Russian traveler Przevalski, who, fifteen years ago, supplied the Museum of St. Petersburg with five specimens. As would naturally be assumed, the animal in question is a two-humped form, and apparently does not differ in any essentials of structure from the ordinary two-humped or Bactrian camel, which, in a domesticated state, is found over

the greater part of Central Asia, and even in parts of Southern Russia. It is a question, whether the animals which have been brought back by Przevalski and Littledale are truly wild, in the sense that non-domestication means wildness, or whether they are not simply the domesticated animal which in one way or another has regained full liberty, and adapted itself to life in wild nature. A condition parallel to this is furnished by the dromedaries of Southern Spain, and by the remnants of the transplanted Texan stock which still lingers in parts of the Rocky Mountains. Referring to Mr. Littledale's find, and as bearing upon the possible ancestry of the domesticated camel, the Director of the British Museum, Sir William Flower, writes as follows: "Wild camels, until recent times, had been quite unknown, and the origin of the domestic camel was, as is the origin of many of our domesticated animals, involved in mystery. The history of the camel, as has been revealed by recent geological explorations, is a very curious one. Though now living in Africa and Asia, we have not at present found any fossil remains of camels in early formations in the Old World; but most unexpectedly, during a survey that began about twenty-five years ago, remarkable fossiliferous deposits were found in pliocene, miocene, and even going back to eocene times in the western part of North America, and there was discovered the original home of the camel; and the American paleontologists have traced it from a primitive generalized form of the group to which the existing camel belongs by a succession of minute changes; but, curiously enough, it became entirely extinct in the region where it seems to have been originally developed. Some, however, emigrated to South America, remaining there in the form of the llama, vicuña, and alpaca found in the Andes of South America and Patagonia; and the other branch appears to have crossed that bridge which once extended across the North Pacific, and spread over the regions of the Old World." Prof. Flower's views as regards the American origin of the cameline animals, and of the camel itself, are held by the foremost American paleontologists, such as Cope, Marsh, Scott and Osborn; but it can

hardly be said that the full facts substantiate this position. It is undeniable that a true cameline line has been furnished by the American deposits; but long before its culmination in an animal nearest to the modern camel, the animal was already in existence in India, as is evidenced by its remains from the deposits of the Sivalik Hills. It is not impossible, therefore, that a true chain of cameline animals was developed independently on the Asiatic continent, culminating in the modern camel; while the parallel American line passed off into the South American forms which to-day represent that animal in the New World.

THE LATE PROF. GEORGE J. ROMANES.

In the death of this distinguished naturalist, which took place a few weeks ago, in the forty-seventh year of the scholar, physiological and philosophical science loses one of its ablest cultivators. Prof. Romanes first became prominent in the outer scientific world through his address on "Animal Intelligence," read before the Dublin meeting of the British Association, in 1878, and subsequently enlarged and republished as one of the volumes of the International Scientific Series. But before this time he had already achieved success among the "closer corporation" of naturalists through his researches into the nervous system of some of the lower animals, such as the jelly-fishes, echinoderms, etc. When only thirty-one years of age he was elected a Fellow of the Royal Society of London, having been, we believe, the youngest Fellow elected at that time to that distinguished body, with the exception of the geologist Judd. Mr. Romanes enjoyed for many years the close friendship of Darwin, by whom his course of investigation was largely determined, and it can truly be said that in him the doctrine of evolution gained one of its most ardent, if not always its safest, champion. The psychological and hereditary aspects of evolution more particularly engrossed his attention during many years, and latterly much of his time has been occupied in defending certain premises assumed by him against the criticisms of naturalists, like Wallace, Weismann,

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Spencer, and Lankester, who believed that Romanes had failed to grasp some of the essential concepts of the evolutionary hypothesis. His views on "Physiological Selection" have met with comparatively little recognition, and, perhaps, while it may appear uncharitable to disparage the work of so prominent a figure in science, it would be no great departure from the truth to say that Romanes's discoveries in the field of science rest with his earlier years of investigation. Probably, the best estimate of his work is furnished by one of his sternest critics, Prof. Lankester, who says: "Whilst it would be premature to claim for Romanes the merit of a great discoverer or originator in psychology, or in the philosophy of evolution, it is nevertheless true that by his keen criticism, careful mastery of details, and great literary fertility, he has exercised a most important influence—stimulating the thought and research of others by his example and enthusiasm, and by those contests in the arena of the 'reviews' with Wallace, Spencer, and Weismann, which have made his name so widely known."

It is interesting to note that in the long line of discussion which Prof. Romanes developed, and in which, apart from its scientific value, it is claimed that the author took an intense delight, looking forward with equal pleasure to a dialectic as to a scientific triumph, the name of Prof. Huxley barely figures; whether from a disinclination to enter the arena with the younger men, or through a belief, shared by many, that much of the new struggle, with its varying aspects of neo-Lamarckism, ultra-Darwinism and Weismannism, has been over words rather than of facts, the great master of evolution has remained silent. Prof. Romanes was a very fertile writer, and nearly all of his works have been translated into French and German; his "Darwin and after Darwin," a popular exposition of the progress of evolution, hardly bears the impress of a scholar, and has been criticised for not making proper acknowledgment to the authorities from whom much of the material of the work is borrowed. Romanes was at the time of his death a resident of Oxford, where he founded the lectureship which bears his

name, and with which the names of Gladstone, Huxley, and Weismann, as first "Romanes lecturers," are associated.

THE CULMINATING POINT OF THE NORTH AMERICAN CONTINENT.

The question as to which of the American mountain summits wears the crown of highest position on the North American Continent, again assumes an interesting phase through the reported discovery of a mountain group in Alaska, in the region of Mount St. Elias, whose altitudinal determination would seem to depose both the Peak of Orizaba (Citlaltepetl) in Mexico and Mount St. Elias—the two peaks which have for some time held the position of honor, and which are so nearly of one height (eighteen thousand three hundred and eighteen thousand two hundred feet), that one might justly hesitate before finally awarding the palm for supremacy. The new mountains, possibly representing merely separated summits of a single mountain, upon which Mr. Israel Russell has bestowed the name of Mount Logan, are reputed to be nineteen thousand five hundred feet in height, or fully equal to what was for many years assumed to be the true height of St. Elias. The small angle of measurement, through which the height of this mountain was computed, does not permit us fully to accept the determination, and it is by no means unlikely that Mount Logan will, on closer scrutiny, share the fate which has befallen so many of the North American mountains, such as St. Elias, Mount Wrangell, Mount Hood, etc.—decapitation. The niceties of absolute measurement in the case of a high mountain are such that only upon a most careful and repeated use of instruments can any dependence be placed, and this applies equally to determinations that are made by the angle and the barometric methods. At the present moment, the height of what has been assumed to be one of the most accurately determined summits of the Karakoram range of India—Mount Godwin Austen, or K_2—has been brought into question, and only recently a resurvey of the Australian Alps has restored Mount Kosciusko, with a height of seven thousand three hundred and thirty-six feet, to the first position

among the Australian mountains; its rival, Mueller's Peak, whose crown has received a special accumulation of visiting-cards, scraps of paper, addressed envelopes, etc., in recognition of its claims to superiority, falls short by sixty-eight feet.

The discrepancies in the results of mountain measurements are such that one is tempted to ask: Are the results obtained by a single investigator worthy of full confidence? The personal element—by which we mean not only the desires and non-desires in a determination, but the method of handling the instruments, the kinds of allowances that are made for instrumental and ocular aberrations, and the uniformity and similarity of the checks that are used to counteract these aberrations—enters so largely, and seemingly so constantly, into any calculation, as to make this almost individual or approximative, rather than positive. Otherwise, indeed, it becomes difficult to explain the differences of results that are obtained by equally competent observers—differences that are in many cases far too great to be explained away on the assumption of special difficulties of measurement. To mention only a few of the higher American summits, toward the measurement of which no special difficulty ought to have been encountered: Aconcagua has been oscillating between twenty-two thousand four hundred and twenty-three thousand nine hundred feet; Chimborazo between twenty thousand and twenty-one thousand four hundred feet; the Illampu between twenty-two thousand and twenty-five thousand feet; Orizaba between seventeen thousand four hundred and eighteen thousand three hundred feet; St. Elias between fourteen thousand and nineteen thousand five hundred feet; Ixtaccihuatl between fifteen thousand seven hundred and sixteen thousand nine hundred and sixty feet. It would almost seem as if there were certain factors involved in mountain measurement which have not yet been fully taken account of, for it is difficult to explain such broad differences on the theory of individual methods alone.

It has become customary, in scientific circles, to disparage the use of the barometer as an instrument of precision in

the determination of heights; and it is unquestionably true that the most refined measurements have been made by angle instruments. But, on the other hand, it is equally true that many of the most divergent results have been obtained through just such angle measurements, in which, especially in the case of lofty snow-capped mountains, a critical method and nicety of instrumental manipulation are required which comparatively few travelers possess. Probably, the average barometric measurement compares favorably with the trigonometric, even if it cannot produce, as an expression of the best, an equal nicety of result.

EXTINCTION OF THE SOUTHERN FUR-SEAL.

Mr. F. R. Chapman contributes to the *Canadian Record of Science* some interesting data regarding the virtual extermination of the fur-seal from the coasts of New Zealand and Tasmania, and of some smaller island groups. The millions of seals which formerly inhabited those regions have so far diminished in numbers that the animal is all but unknown to the existing population. On the southern coast of New Zealand, prior to 1825, seals were so abundant that in a single season shore-parties secured as many as one hundred thousand skins; at the present time, it is said, that not a seal is to be seen in those tracts sometimes for a period of ten years. The waters of the Snares, Auckland, Campbell, and Macquarie Islands have been similarly depleted. It is claimed that this rapid extermination is due primarily to reckless slaughtering, a condition analogous to that which obtained until recent years, and still obtains to an extent, along the Newfoundland coast. Protective legislation, although coming late, may yet do something to restock the deserted waters, but it would appear that for much of the regions little can now be done.

THE BRAIN OF THE CHINAMAN.

A singularly interesting contribution to the science of anthropology has recently been made by Mr. C. H. Bond in his study of the Chinaman's brain, the results of which are published in the English journal *Brain*. Incredible though it

may appear, it would seem that up to this time the brains of only eight "Celestials" have been reported upon. Mr. Bond emphasizes certain well-marked departures—assuming the brain studied by him to be normal—of the Chinese brain from that of other people, the most pronounced of which is the inordinately large size of the cerebellum as compared with the cerebrum. The proportion stands in the relation of one to five, instead of one to eight and one-half, as in the average man, and is, therefore, very nearly what is to be found in the chimpanzee (one to five and three-fourths). The total brain-weight was found to be one thousand one hundred and eighty-two grammes, or only one hundred and seventy-six grammes less than that of the average male adult brain, while in the convolutional complexity of the frontal lobes it somewhat surpassed what is assumed to be the normal. The transverse furrows are more prominent than the antero-posterior ones.

OCEANIC CHARTING.

The importance of the work that is being carried on by the hydrographic bureaus of different countries for the determination of danger rocks and shoals, and of other impediments to safe navigation, is illustrated by the report, recently published, of the hydrographer of the British Admiralty, which shows that in the past year not less than two hundred and one danger points had to be charted, and notification of the existence of such positions sent to the mariners. Of this number, twenty-six were rocks reported by H. M. surveying vessels; thirty-five similar obstructions discovered by others of H. M. ships; twenty-two reported by various British and foreign vessels; thirteen discovered by vessels striking upon them, and one hundred and five reported by colonial and foreign governments. Ten English vessels were employed in this survey during the year, and perhaps the best work accomplished by them was on the west Newfoundland coast. Over an explored area of about five hundred square miles, it is claimed that no chart, in which the navigator can place any confidence, exists at the present time.